



LC840EQD

Product Specification

SPECIFICATION FOR APPROVAL

 (●) Preliminary Specification () Final Specification

Title	84.0" QWUXGA TFT LCD
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BUYER	General
MODEL	

SUPPLIER	LG Display Co., Ltd.
*MODEL	LC840EQD
SUFFIX	SEM1 (RoHS Verified)

*When you obtain standard approval,
please use the above model name without suffix

APPROVED BY	SIGNATURE DATE
/	_____
/	_____
/	_____
Please return 1 copy for your confirmation with your signature and comments.	

APPROVED BY	SIGNATURE DATE
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S.W. Yu / Project Leader	_____
PREPARED BY	
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TV Product Development Dept. LG Display Co., Ltd.	

Ver. 0.1

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RECORD OF REVISIONS

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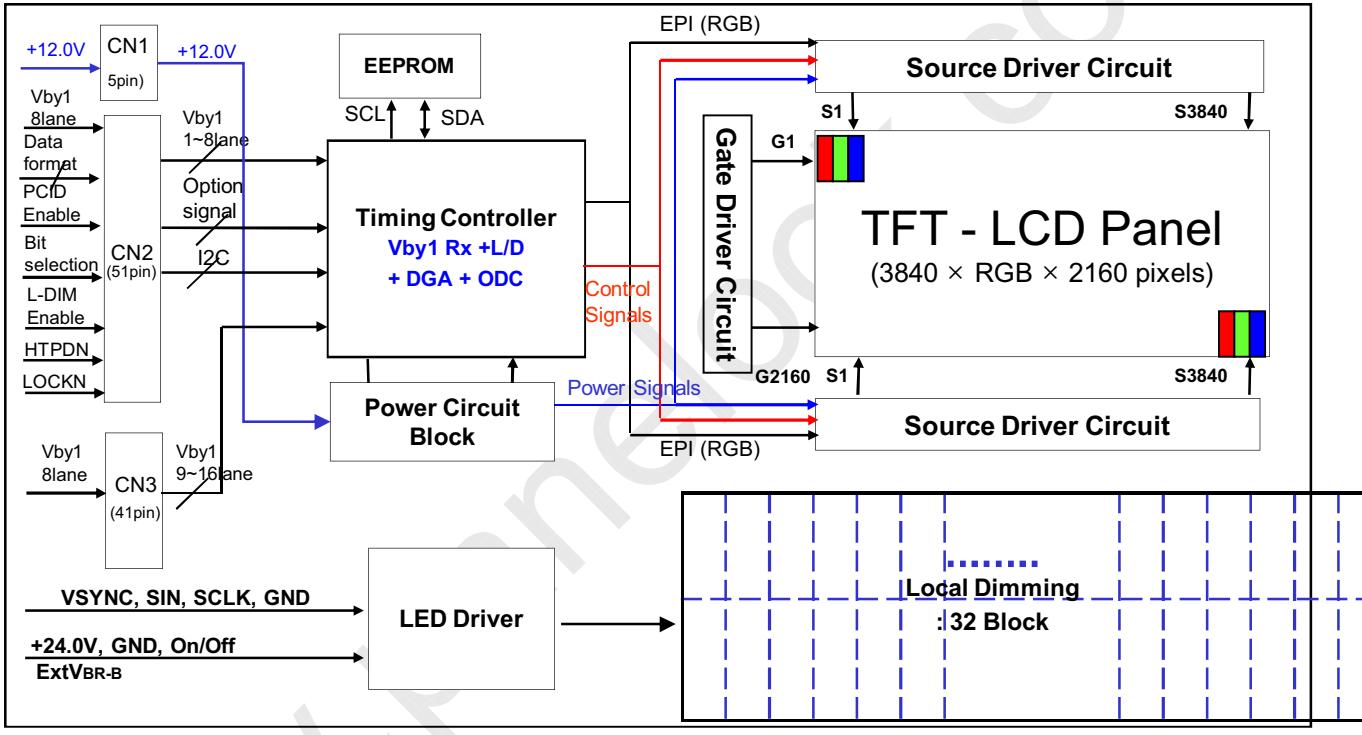
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1. General Description

The LC840EQD is a Color Active Matrix Liquid Crystal Display with an integral Light Emitting Diode (LED) backlight system. The matrix employs a-Si Thin Film Transistor as the active element. It is a transmissive display type which is operating in the normally black mode. It has a 84.04 inch diagonally measured active display area with QWUXGA resolution (2160 vertical by 3840 horizontal pixel array). Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arrayed in vertical stripes. Gray scale or the luminance of the sub-pixel color is determined with a 10-bit gray scale signal for each dot. Therefore, it can present a palette of more than 1.06Billion colors.

It has been designed to apply the 10-bit 16 Lane V by One interface.

It is intended to support LCD TV, PCTV where high brightness, super wide viewing angle, high color gamut, high color depth and fast response time are important.



Active Screen Size	84.04 inches(2134.62 mm) diagonal
Outline Dimension	1904.0(H) × 1096.0(V) X 15.5(B) /24.0 mm(D) (Typ.)
Pixel Pitch	0.4845 mm x 0.4845 mm
Pixel Format	3840 horiz. by 2160 vert. Pixels, RGB stripe arrangement
Color Depth	10bit(D), 1.06Billion colors
Luminance, White	350 cd/m ² (Center 1point ,Typ.)
Viewing Angle (CR>10)	Viewing angle free (R/L 178 (Min.), U/D 178 (Min.))
Power Consumption	Total 412W (TBD) (Typ.) [Logic= 17(TBD)W, LED Driver=395(TBD)W (ExtVbr_B=100%)]
Weight	43.5 Kg(TBD) (Typ.)
Display Mode	Transmissive mode, Normally black
Surface Treatment	Hard coating(3H), Anti-glare treatment of the front polarizer (Haze < 1%)

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2. Absolute Maximum Ratings

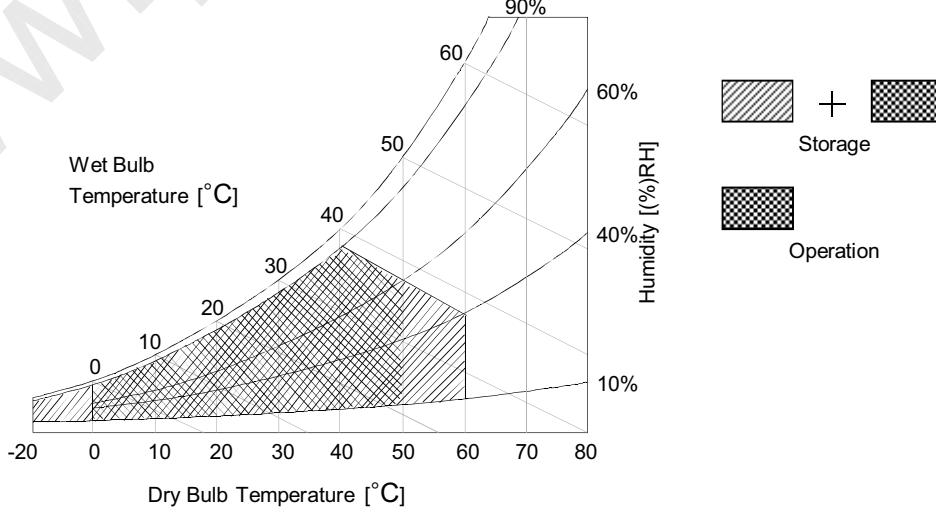
The following items are maximum values which, if exceeded, may cause faulty operation or permanent damage to the LCD module.

Table 1. ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Value		Unit	notes
		Min	Max		
Power Input Voltage	LCD Circuit	V _{LCD}	-0.3	+14.0	V _D C
	Driver	V _{BL}	-0.3	+27.0	V _D C
Driver Control Voltage	ON/OFF	V _{OFF} / V _{ON}	-0.3	+5.5	V _D C
	Brightness	EXTV _{BR-B}	0.0	+5.5	V _D C
T-Con Option Selection Voltage	V _{LOGIC}	-0.3	+4.0	V _D C	
Operating Temperature	T _{OP}	0	+50	°C	2,3
Storage Temperature	T _{ST}	-20	+60	°C	
Panel Front Temperature	T _{SUR}	-	+68	°C	4
Operating Ambient Humidity	H _{OP}	10	90	%RH	2,3
Storage Humidity	H _{ST}	10	90	%RH	

notes :1. Ambient temperature condition (Ta = 25 ± 2 °C)

2. Temperature and relative humidity range are shown in the figure below.
Wet bulb temperature should be Max 39°C, and no condensation of water.
3. Gravity mura can be guaranteed below 40°C condition.
4. The maximum operating temperatures is based on the test condition that the surface temperature of display area is less than or equal to 68°C with LCD module alone in a temperature controlled chamber. Thermal management should be considered in final product design to prevent the surface temperature of display area from being over 68 °C . The range of operating temperature may be degraded in case of improper thermal management in final product design.



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3. Electrical Specifications**3-1. Electrical Characteristics**

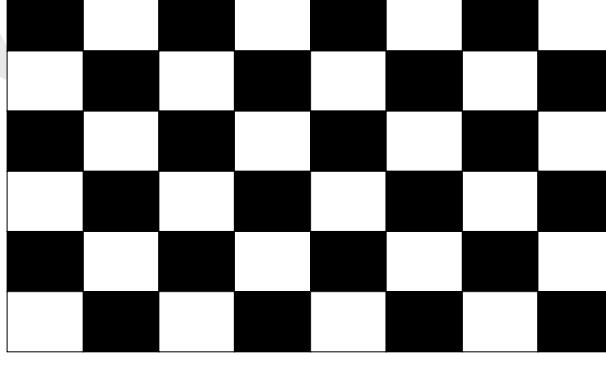
It requires two power inputs. One is employed to power for the LCD circuit. The other is used for the LED backlight and LED Driver circuit.

Table 2. ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Value			Unit	notes
		Min	Typ	Max		
Circuit :						
Power Input Voltage	V _{LCD}	10.8	12.0	13.2	V _{DC}	
Power Input Current	I _{LCD}	-	1400(TBD)	1820(TBD)	mA	1
		-	4500(TBD)	5850(TBD)	mA	2
Power Consumption	P _{LCD}	-	16.8(TBD)	21.8(TBD)	Watt	1
Rush current	I _{RUSH}	-	-	8.0(TBD)	A	3

- notes : 1. The specified current and power consumption are under the $V_{LCD}=12.0V$, $T_a=25 \pm 2^{\circ}C$, $f_V=120Hz$ condition, and mosaic pattern(8 x 6) is displayed and f_V is the frame frequency.
 2. The current is specified at the maximum current pattern.
 3. The duration of rush current is about 2ms and rising time of power input is 0.5ms (min.).
 4. Ripple voltage level is recommended under $\pm 5\%$ of typical voltage

White : 1023 Gray
 Black : 0 Gray

**Mosaic Pattern(8 x 6)**

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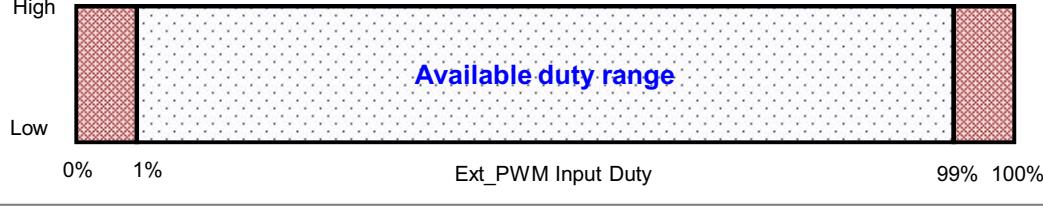
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Table 3. ELECTRICAL CHARACTERISTICS (Continue)

Parameter	Symbol	Values			Unit	Notes
		Min	Typ	Max		
LED Driver :						
Power Supply Input Voltage	VBL	22.8	24.0	25.2	Vdc	1
Power Supply Input Current	IBL	-	16.5 (TBD)	17.0(TBD)	A	1
Power Supply Input Current (In-Rush)	In-rush	-	-	21.0(TBD)	A	VBL = 22.8V Ext VBR-B = 100% 4
Power Consumption	PBL	-	395(TBD)	407(TBD)	W	1
Input Voltage for Control System Signals	On/Off	On	V on	2.5	-	5.0
		Off	V off	-0.3	0.0	0.7
	Brightness Adjust		ExtVBR-B	1	-	100 %
	PWM Frequency for NTSC & PAL		PAL	100		Hz
			NTSC	120		Hz
	Pulse Duty Level (PWM)		High Level	2.5	-	5.0
			Low Level	0.0	-	0.7
LED :						
Life Time		30,000	50,000		Hrs	2

Notes :

- Electrical characteristics are determined after the unit has been 'ON' and stable for approximately 60 minutes at $25 \pm 2^\circ\text{C}$. The specified current and power consumption are under the typical supply Input voltage 24Vand VBR (ExtVBR-B : 100%), it is total power consumption.
- The life time (MTTF) is determined as the time which luminance of the LED is 50% compared to that of initial value at the typical LED current (ExtVBR-B :100%) on condition of continuous operating in LCM state at $25 \pm 2^\circ\text{C}$.
- LGD recommend that the PWM freq. is synchronized with One time harmonic of V_sync signal of system. Though PWM frequency is over 120Hz (max 252Hz), function of LED Driver is not affected.
- The duration of rush current is about 200ms. This duration is applied to LED on time
- Even though inrush current is over the specified value, there is no problem if I^2T spec of fuse is satisfied.
- Ext_PWM Signal have to input available duty range.
Between 99% and 100% ExtVBR-B duty have to be avoided. ($99\% < \text{ExtVBR-B} < 100\%$)
But ExtVBR-B 0% and 100% is possible.



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3-2. Interface Connections

This LCD module employs three kinds of interface connection, 5-pin connector, 51-pin connector and 41-pin connector are used for the module electronics and 14-pin,12-pin connector is used for the integral backlight system.

3-2-1. LCD Module

- LCD Connector(CN1): SM05B-PASS-TB(manufactured by JST)
- Mating Connector : PAP-05V-S(JST) or compatible

Table 4-1. MODULE CONNECTOR(CN1) PIN CONFIGURATION

No	Symbol	Description
1	GND	Ground
2	GND	Ground
3	VLCD	Power Supply +12.0V
4	VLCD	Power Supply +12.0V
5	VLCD	Power Supply +12.0V

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- LCD Connector(CN1): FI-RE51S-HF(manufactured by JAE)
- Mating Connector : FI-R51HL(JAE) or compatible

Table 4-2. MODULE CONNECTOR(CN2) PIN CONFIGURATION

No	Symbol	Description	No	Symbol	Description
1	NC (Reserved)	Power Supply +12.0V (reserved)	27	GND	Ground
2	NC (Reserved)	Power Supply +12.0V (reserved)	28	Rx0n	V-by-One HS Data Lane 0
3	NC (Reserved)	Power Supply +12.0V (reserved)	29	Rx0p	V-by-One HS Data Lane 0
4	NC (Reserved)	Power Supply +12.0V (reserved)	30	GND	Ground
5	NC (Reserved)	Power Supply +12.0V (reserved)	31	Rx1n	V-by-One HS Data Lane 1
6	NC (Reserved)	Power Supply +12.0V (reserved)	32	Rx1p	V-by-One HS Data Lane 1
7	NC (Reserved)	Power Supply +12.0V (reserved)	33	GND	Ground
8	NC (Reserved)	Power Supply +12.0V (reserved)	34	Rx2n	V-by-One HS Data Lane 2
9	NC	NO CONNECTION (notes 4)	35	Rx2p	V-by-One HS Data Lane 2
10	GND	Ground	36	GND	Ground
11	GND	Ground	37	Rx3n	V-by-One HS Data Lane 3
12	GND	Ground	38	Rx3p	V-by-One HS Data Lane 3
13	GND	Ground	39	GND	Ground
14	GND	Ground	40	Rx4n	V-by-One HS Data Lane 4
15	Data format 0	Input Data Format [1:0] : '00'=Mode1, '01'=Mode2, '10'=Mode3, '11'=Mode4	41	Rx4p	V-by-One HS Data Lane 4
16	Data format 1		42	GND	Ground
17	NC	NO CONNECTION (notes 4)	43	Rx5n	V-by-One HS Data Lane 5
18	NC	NO CONNECTION (notes 4)	44	Rx5p	V-by-One HS Data Lane 5
19	NC	NO CONNECTION (notes 4)	45	GND	Ground
20	NC	NO CONNECTION (notes 4)	46	Rx6n	V-by-One HS Data Lane 6
21	Bit SEL	'H' or NC= 10bit(D), 'L' = 8bit	47	Rx6p	V-by-One HS Data Lane 6
22	L-DIM Enable	'H' = Enable , 'L' or NC = Disable	48	GND	Ground
23	GND	Ground (notes 7)	49	Rx7n	V-by-One HS Data Lane 7
24	GND	Ground	50	Rx7p	V-by-One HS Data Lane 7
25	HTPDN	Hot plug detect	51	GND	Ground
26	LOCKN	Lock detect	-	-	-

- notes
1. All GND (ground) pins should be connected together to the LCD module's metal frame.
 2. #1~#8 NC (No connection) : These pins are used for back up power source, V_{LCD} (power input) .
These pins are should be connected together.
 3. All Input levels of V-by-One signals are based on the V-by-One HS Standard Version 1.3.
 4. #9 & #17~#20 NC (No Connection) : These pins are used only for LGD (Do not connect)
 5. Specific pin (#22) is used for Local Dimming function of the LCD module.
If not used, these pins are no connection. (Please see the **Appendix IV-2** for more information.)
 6. About specific pin (#15,#16) , Please see the **Appendix VIII**.
 7. Specific pin No. #23 is used for "No signal detection" of system signal interface.
It should be GND for NSB (No Signal Black) while the system interface signal is not.
If this pin is "H" or "NC", LCD Module displays AGP (Auto Generation Pattern).

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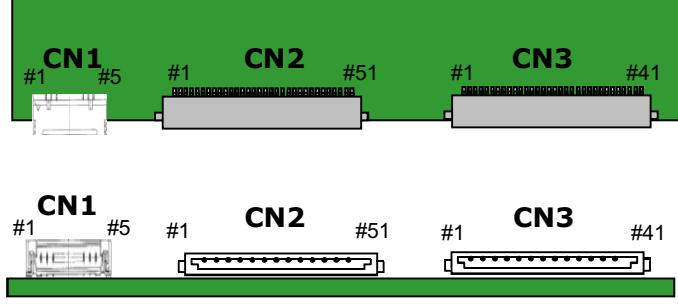
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- LCD Connector (CN2) : FI-RE41S-HF (manufactured by JAE)
- Mating Connector : FI-RE41HL or compatible

Table 4-3. MODULE CONNECTOR(CN3) PIN CONFIGURATION

No	Symbol	Description	No	Symbol	Description
1	GND	Ground	22	GND	Ground
2	Rx8n	V-by-One HS Data Lane 8	23	Rx15n	V-by-One HS Data Lane 15
3	Rx8p	V-by-One HS Data Lane 8	24	Rx15p	V-by-One HS Data Lane 15
4	GND	Ground	25	GND	Ground
5	Rx9n	V-by-One HS Data Lane 9	26	NC	NO CONNECTION
6	Rx9p	V-by-One HS Data Lane 9	27	NC	NO CONNECTION
7	GND	Ground	28	NC	NO CONNECTION
8	Rx10n	V-by-One HS Data Lane 10	29	NC	NO CONNECTION
9	Rx10p	V-by-One HS Data Lane 10	30	NC	NO CONNECTION
10	GND	Ground	31	NC	NO CONNECTION
11	Rx11n	V-by-One HS Data Lane 11	32	NC	NO CONNECTION
12	Rx11p	V-by-One HS Data Lane 11	33	NC	NO CONNECTION
13	GND	Ground	34	NC	NO CONNECTION
14	Rx12n	V-by-One HS Data Lane 12	35	NC	NO CONNECTION
15	Rx12p	V-by-One HS Data Lane 12	36	NC	NO CONNECTION
16	GND	Ground	37	NC	NO CONNECTION
17	Rx13n	V-by-One HS Data Lane 13	38	NC	NO CONNECTION
18	Rx13p	V-by-One HS Data Lane 13	39	NC	NO CONNECTION
19	GND	Ground	40	NC	NO CONNECTION
20	Rx14n	V-by-One HS Data Lane 14	41	NC	NO CONNECTION
21	Rx14p	V-by-One HS Data Lane 14	-		

- notes :
1. All GND (ground) pins should be connected together to the LCD module's metal frame.
 2. #26~#41 NC (No Connection) : These pins are used only for LGD (Do not connect)

**Rear view of LCM**

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3-2-2. Backlight Module

Master

-LED Driver Connector

: 20022WR - H14B2(Yeonho) , 20022WR-H12B2(Yeonho)

- Mating Connector

: 20022HS-H14B2(Yeonho),20022HS-H12B2(Yeonho) or Compatible

Table 5-1. LED DRIVER CONNECTOR PIN CONFIGURATION

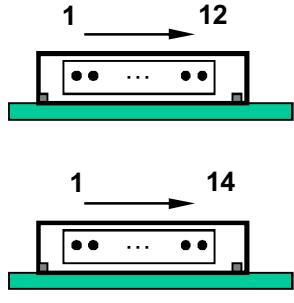
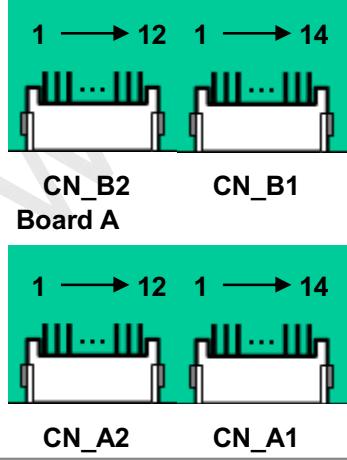
Pin No	Symbol	Description (CN_A1/CN_A2)	Description (CN_A2/CN_B2)	Note
1	VBL	Power Supply +24.0V	Power Supply +24.0V	
2	VBL	Power Supply +24.0V	Power Supply +24.0V	
3	VBL	Power Supply +24.0V	Power Supply +24.0V	
4	VBL	Power Supply +24.0V	Power Supply +24.0V	
5	VBL	Power Supply +24.0V	Power Supply +24.0V	
6	GND	Backlight Ground	Backlight Ground	
7	GND	Backlight Ground	Backlight Ground	
8	GND	Backlight Ground	Backlight Ground	1
9	GND	Backlight Ground	Backlight Ground	
10	GND	Backlight Ground	Backlight Ground	
11	Status	Backlight Status	Don't care	2
12	VON/OFF	Backlight ON/OFF control	Don't care	
13	NC	Don't care		
14	EXTVBR_B	External PWM		3

notes : 1. GND should be connected to the LCD module's metal frame.

2. Normal : Low (under 0.7V) / Abnormal : Open
3. High : on duty / Low : off duty, Pin#14 can be opened. (if Pin #14 is open , EXTVBR-B is 100%)
4. Each impedance of pin #12 and 14 is over 50 [KΩ] .

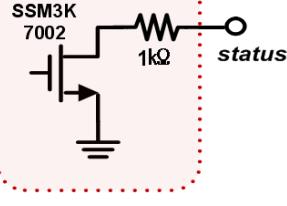
◆ Rear view of LCM

Board B



◆ Status

Driver



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3-3. Signal Timing Specifications

Table 6 shows the signal timing required at the input of the LVDS transmitter. All of the interface signal timings should be satisfied with the following specification for normal operation.

Table 6. TIMING TABLE (DE Only Mode)

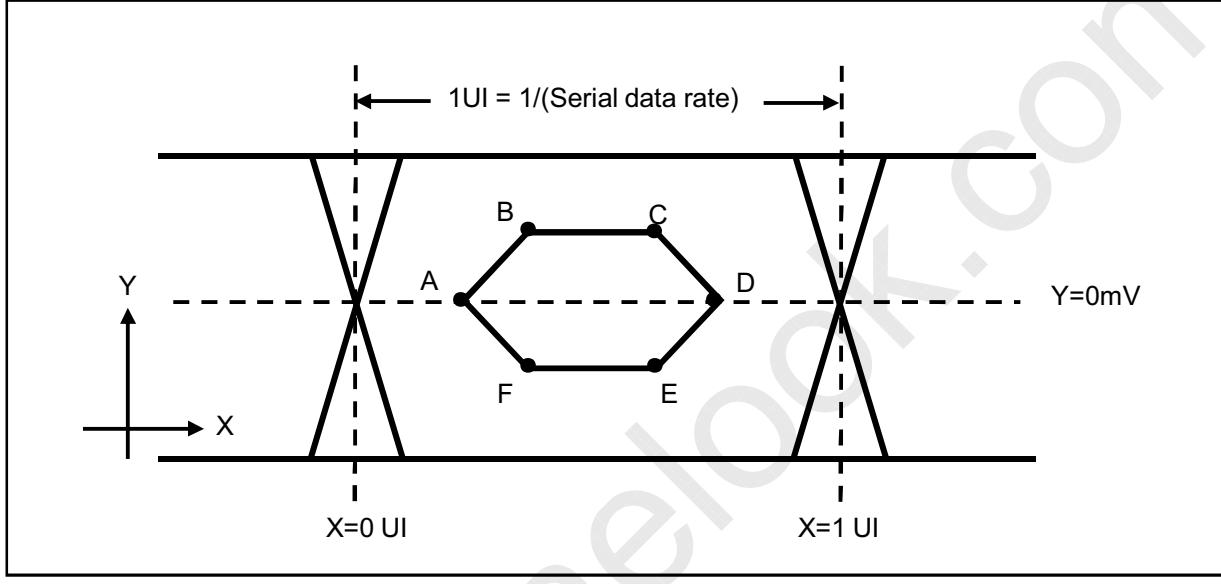
ITEM		Symbol	Min	Typ	Max	Unit	Note
Horizontal	Display Period	t_{HV}	240	240	240	t_{CLK}	3840/16
	Blank	t_{HB}	25	35	60	t_{CLK}	1
	Total	t_{HP}	265	275	300	t_{CLK}	
Vertical	Display Period	t_{VV}	2160	2160	2160	Lines	
	Blank	t_{VB}	40 (456)	90 (540)	172 (600)	Lines	1
	Total	t_{VP}	2200 (2616)	2250 (2700)	2332 (2760)	Lines	

ITEM		Symbol	Min	Typ	Max	Unit	Note
Frequency	DCLK	f_{CLK}	67	74.25	78.00	MHz	1188/16
	Horizontal	f_H	244	270	280	KHz	1
	Vertical	f_V	108 (95)	120 (100)	122 (104)	Hz	2 NTSC (PAL)

- notes:
1. The input of HSYNC & VSYNC signal does not have an effect on normal operation (DE Only Mode). If you use spread spectrum of EMI, add some additional clock to minimum value for clock margin.
 2. The performance of the electro-optical characteristics may be influenced by variance of the vertical refresh rate and the horizontal frequency
- * Timing should be set based on clock frequency.

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3-4. V by One input signal Characteristics**3-4-1. V by One Input Signal Timing Diagram****Table7. Eye Mask Specification**

	X[UI]	Note	Y[mV]	Note
A	0.25 (max)	2	0	-
B	0.3 (max)	2	50	3
C	0.7(min)	3	50	3
D	0.75(min)	3	0	-
E	0.7(min)	3	-50	3
F	0.3(max)	2	-50	3

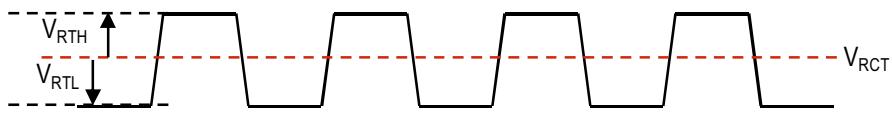
- notes
1. All Input levels of V by One signals are based on the V by One HS Standard Ver. 1.3
 2. This is allowable maximum value.
 3. This is allowable minimum value.
 4. The eye diagram is measured by the oscilloscope and receiver CDR characteristic must be emulated.
 - PLL bandwidth : 11 Mhz
 - Damping Factor : 1

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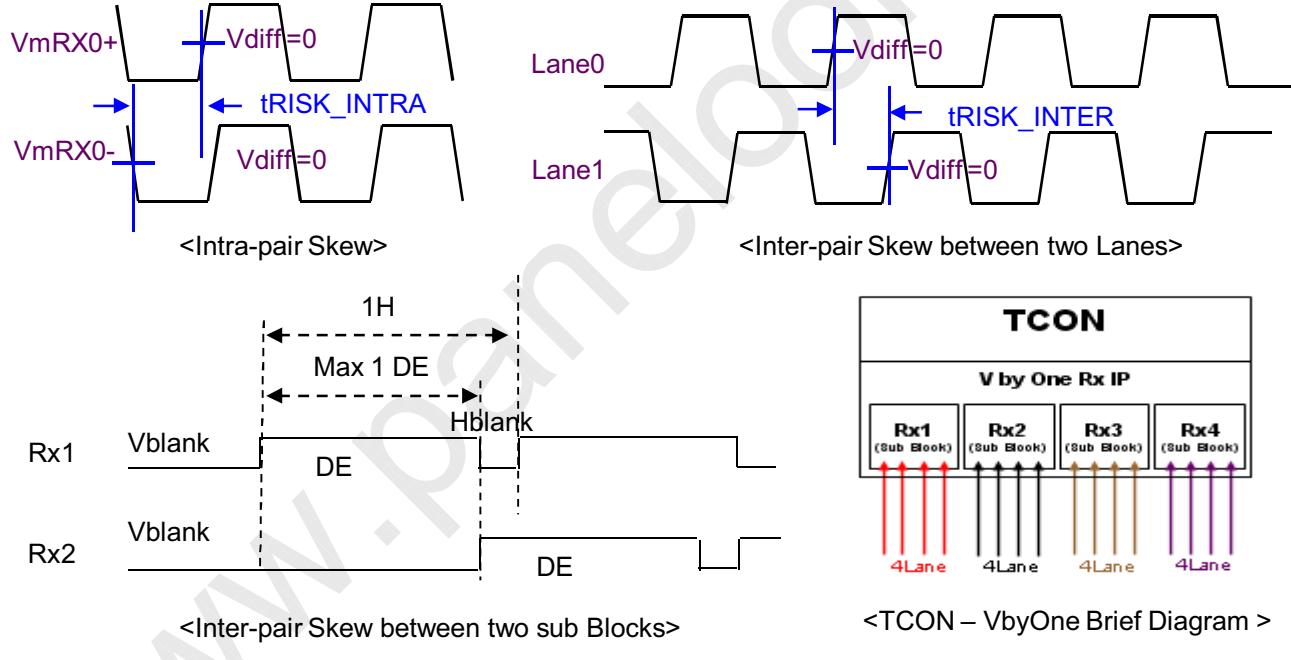
3-4-2. V by One Input Signal Characteristics

1) DC Specification



Description	Symbol	Min	Max	Unit	notes
CML Differential input High threshold	V_{RTH}	-	50	mV	-
CML Differential input Low threshold	V_{RTL}	-50	-	mV	-
CML Common mode Bias Voltage	V_{RCT}	0.6	0.8	V	-

2) AC Specification



Description	Symbol	Min	Max	Unit	notes
Allowable intra-pair skew	$tRISK_INTRA$	-	0.3	UI	1,2
Allowable inter-pair skew between lanes	$tRISK_INTER$	-	5	UI	1,3
Allowable inter-pair skew between sub-blocks	$tRISK_BLOCK$	-	1	DE	1,4

Notes 1.1UI = 1/serial data rate

2. it is the time difference between the true and complementary single-ended signals.
3. it is the time difference of the differential voltage between any two lanes in one sub block.
4. it is the time difference of the differential voltage between any two blocks in one IP.

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3-5. Color Data Reference

The brightness of each primary color (red, green, blue) is based on the 10bit or 8bit gray scale data input for the color. The higher binary input, the brighter the color. Table 8 provides a reference for color versus data input.

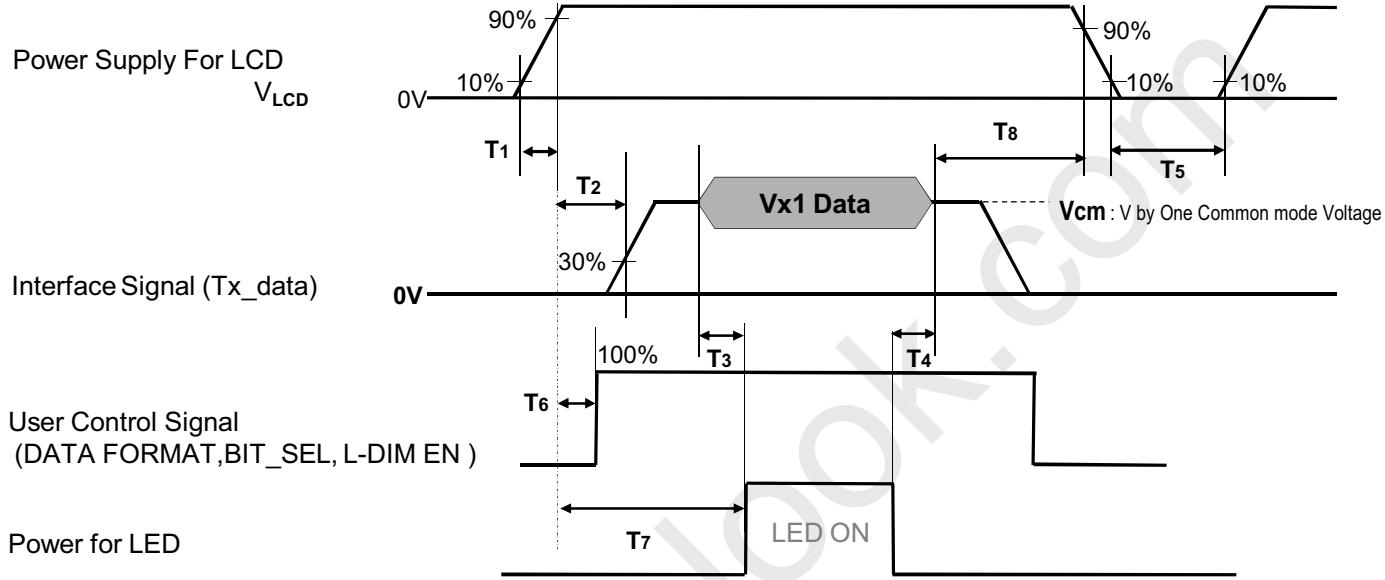
Table 8. COLOR DATA REFERENCE

Packer input & Unpacker output		30bpp RGB (10bit)	24bpp RGB (8bit)
Byte0	D[0]	R[2]	R[0]
	D[1]	R[3]	R[1]
	D[2]	R[4]	R[2]
	D[3]	R[5]	R[3]
	D[4]	R[6]	R[4]
	D[5]	R[7]	R[5]
	D[6]	R[8]	R[6]
	D[7]	R[9]	R[7]
Byte1	D[8]	G[2]	G[0]
	D[9]	G[3]	G[1]
	D[10]	G[4]	G[2]
	D[11]	G[5]	G[3]
	D[12]	G[6]	G[4]
	D[13]	G[7]	G[5]
	D[14]	G[8]	G[6]
	D[15]	G[9]	G[7]
Byte2	D[16]	B[2]	B[0]
	D[17]	B[3]	B[1]
	D[18]	B[4]	B[2]
	D[19]	B[5]	B[3]
	D[20]	B[6]	B[4]
	D[21]	B[7]	B[5]
	D[22]	B[8]	B[6]
	D[23]	B[9]	B[7]
Byte3	D[24]	Don't care	
	D[25]	Don't care	
	D[26]	B[0]	
	D[27]	B[1]	
	D[28]	G[0]	
	D[29]	G[1]	
	D[30]	R[0]	
	D[31]	R[1]	

Notes 1. 30bpp RGB (10bit) is 4 byte mode, otherwise (24bpp RGB) 3byte mode

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3-6. Power Sequence**3-6-1. LCD Driving circuit****Table 9. POWER SEQUENCE**

Parameter	Value			Unit	notes
	Min	Typ	Max		
T1	0.5	-	20	ms	1
T2	0	-	-	ms	2
T3	200	-	-	ms	3
T4	200	-	-	ms	3
T5	1.0	-	-	s	4
T6	-	-	T2	ms	5
T7	0.5	-	-	s	6
T8	100	-	-	ms	7

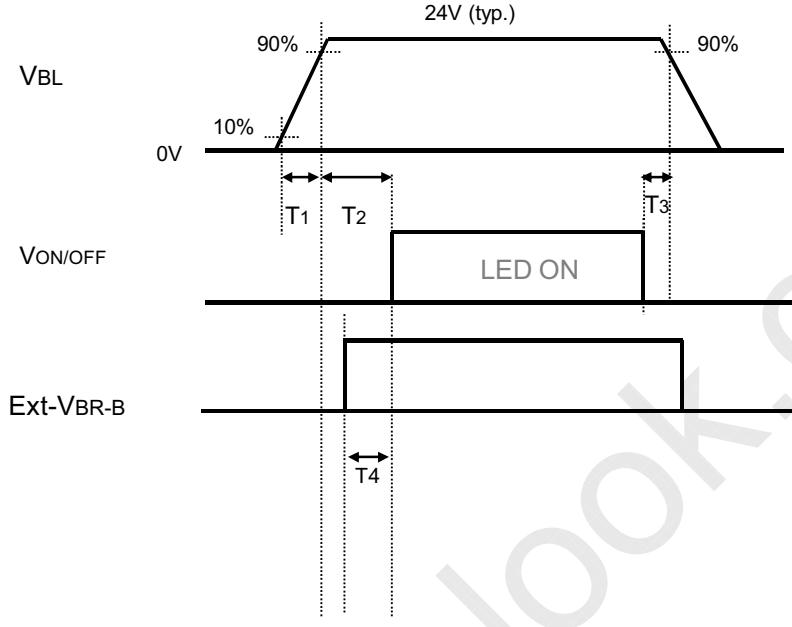
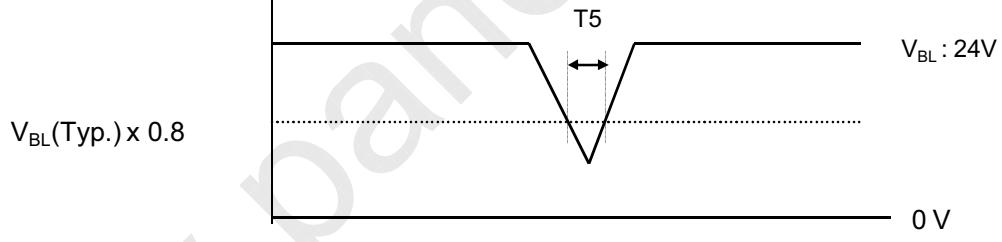
- notes :
- Even though T1 is over the specified value, there is no problem if I2T Spec. of fuse is satisfied.
 - If T2 is satisfied with specification after removing V-by-One Cable, there is no problem.
 - The T3 / T4 is recommended value, the case when failed to meet a minimum specification, abnormal display would be shown. There is no reliability problem.
 - T5 should be measured after the Module has been fully discharged between power off and on period.
 - If the on time of signals (Interface signal and user control signals) precedes the on time of Power (V_{LCD}), it will be happened abnormal display. When T6 is NC status, T6 doesn't need to be measured.
 - If there is no abnormal display, no problem.
 - It is recommendation specification that T8 has to be 100ms as a minimum value.
 - * Please avoid floating state of interface signal at invalid period.
 - * When the power supply for LCD (V_{LCD}) is off, be sure to pull down the valid and invalid data to 0V.
 - * There is no problem even though LOCKN/HTPDN Signal is on before T1.

LC840EQD

Product Specification

3-6-2. Sequence for LED Driver

Power Supply For LED Driver

**3-6-3. Dip condition for LED Driver****Table 10. Power Sequence for LED Driver**

Parameter	Values			Units	Remarks
	Min	Typ	Max		
T1	20	-	-	ms	1
T2	500	-	-	ms	
T3	10	-	-	ms	
T4	0	-	-	ms	
T5	-	-	10	ms	V_{BL} (Typ) $\times 0.8$

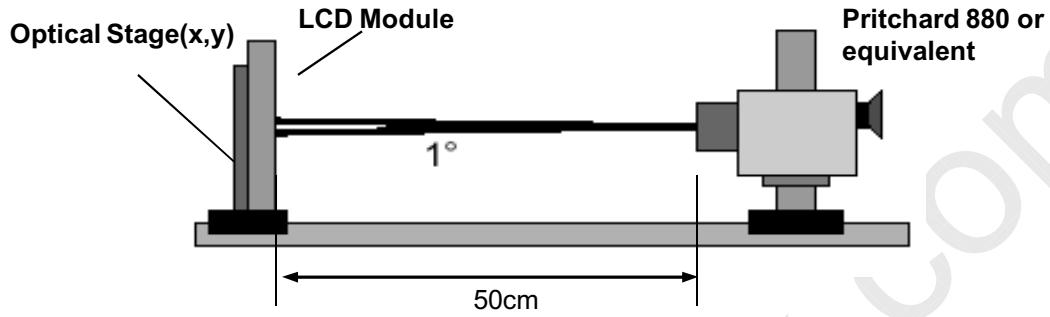
notes : 1. T1 describes rising time of 0V to 24V and this parameter does not apply at restarting time.
Even though T1 is over the specified value, there is no problem if I^2T spec of fuse is satisfied.

LC840EQD

Product Specification

4. Optical Specification

Optical characteristics are determined after the unit has been 'ON' and stable in a dark environment at $25 \pm 2^\circ\text{C}$. The values are specified at distance 50cm from the LCD surface at a viewing angle of Φ and θ equal to 0° . FIG. 1 shows additional information concerning the measurement equipment and method.

**FIG. 1 Optical Characteristic Measurement Equipment and Method**

$T_a = 25 \pm 2^\circ\text{C}$, $V_{LCD} = 12.0\text{V}$, $f_v = 120\text{Hz}$, $Dclk = 74.25\text{MHz}$,

$EXTV_{BR-B} = 100\%$

Table 11. OPTICAL CHARACTERISTICS

Parameter	Symbol	Value			Unit	notes
		Min	Typ	Max		
Contrast Ratio	CR	1100(TBD)	1600(TBD)	-		1
Surface Luminance, white	L_{WH}	280	350		cd/m ²	2
Luminance Variation	δ_{WHITE}	5P		1.4		3
Response Time	Gray-to-Gray	G to G	-	5(TBD)	8	ms
	MPRT	MPRT	-	8(TBD)	12	
	Uniformity	δ_{MPRT}	-	-	1	
	Uniformity	$\delta_{G TO G}$	-	-	1	
Color Coordinates [CIE1931]	RED	Rx		TBD		
		Ry		TBD		
	GREEN	Gx		TBD		
		Gy	Typ	TBD	Typ	
	BLUE	Bx	-0.03	TBD	+0.03	
		By		TBD		
	WHITE	Wx		0.279		
		Wy		0.292		
Color Temperature				10,000		K
Color Gamut				72		%
Viewing Angle (CR >10)	right($\phi=0^\circ$)	θ_r (x axis)	89	-	-	
	left ($\phi=180^\circ$)	θ_l (x axis)	89	-	-	
	up ($\phi=90^\circ$)	θ_u (y axis)	89	-	-	degree
	down ($\phi=270^\circ$)	θ_d (y axis)	89	-	-	
Gray Scale			-	-	-	7

LC840EQD

Product Specification

notes : 1. Contrast Ratio(CR) is defined mathematically as :

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

It is measured at center 1-point.

2. Surface luminance is determined after the unit has been 'ON' and 1 Hour after lighting the backlight in a dark environment at $25 \pm 2^\circ\text{C}$. Surface luminance is the luminance value at center 1-point across the LCD surface 50cm from the surface with all pixels displaying white.
For more information see the FIG. 2.

3. The variation in surface luminance , δ WHITE is defined as :

$$\delta \text{ WHITE(5P)} = \text{Maximum}(L_{on1}, L_{on2}, L_{on3}, L_{on4}, L_{on5}) / \text{Minimum}(L_{on1}, L_{on2}, L_{on3}, L_{on4}, L_{on5})$$

Where L_{on1} to L_{on5} are the luminance with all pixels displaying white at 5 locations .

For more information, see the FIG. 2.

4. Response time is the time required for the display to transit from G(N) to G(M) (Rise Time, T_{rR}) and from G(M) to G(N) (Decay Time, T_{rD}). For additional information see the FIG. 3. ($N < M$)

* G to G Spec stands for average value of all measured points.

Photo Detector : RD-80S / Field : 2°

5. MPRT is defined as the 10% to 90% blur-edge width B_{ij} (pixels) and scroll speed U (pixels/frame)at the moving picture. For more information, see FIG 4

- *. Gray to Gray / MPRT Response time uniformity is Reference data. Appendix VI-1/ VI-2

6. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD module surface. For more information, see the FIG. 5.

7. Gray scale specification

Gamma Value is approximately 2.2. For more information, see the Table 12.

Table 12. GRAY SCALE SPECIFICATION

Gray Level	Luminance [%] (Typ)
L0	0.06
L63	0.27
L127	1.04
L191	2.49
L255	4.68
L319	7.66
L383	11.5
L447	16.1
L511	21.6
L575	28.1
L639	35.4
L703	43.7
L767	53.0
L831	63.2
L895	74.5
L959	86.7
L1023	100

LC840EQD

Product Specification

Measuring point for surface luminance & measuring point for luminance variation.

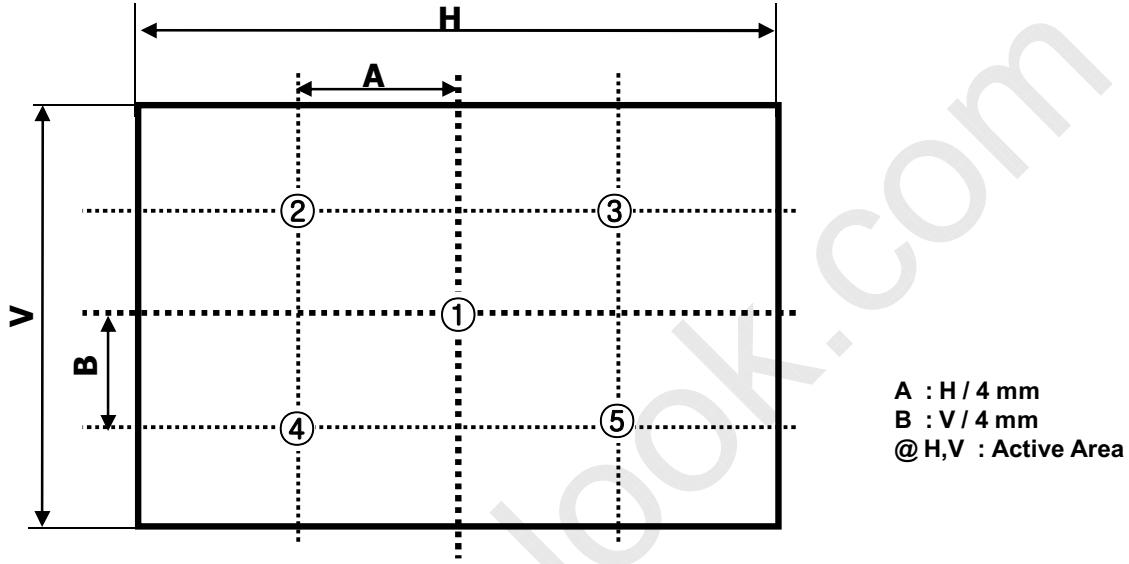


FIG. 2 5 Points for Luminance Measure

Response time is defined as the following figure and shall be measured by switching the input signal for "Gray(N)" and "Gray(M)".

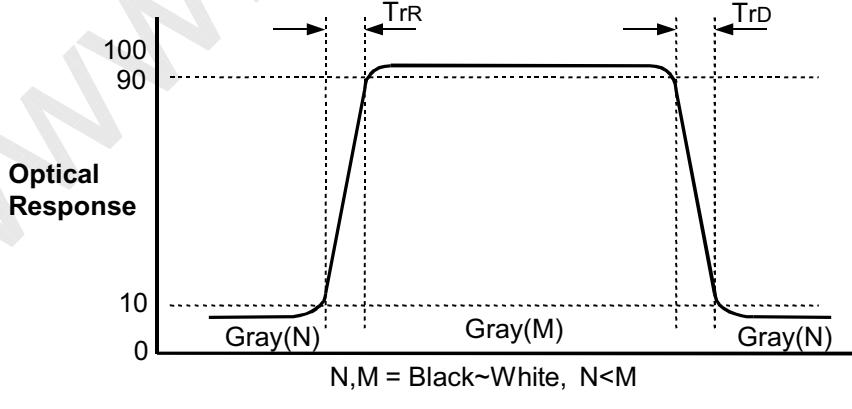


FIG. 3 Response Time

LC840EQD

Product Specification

MPRT is defined as the 10% to 90% blur-edge with B_{ij} (pixels) and scroll speed U (pixels/frame) at the moving picture.

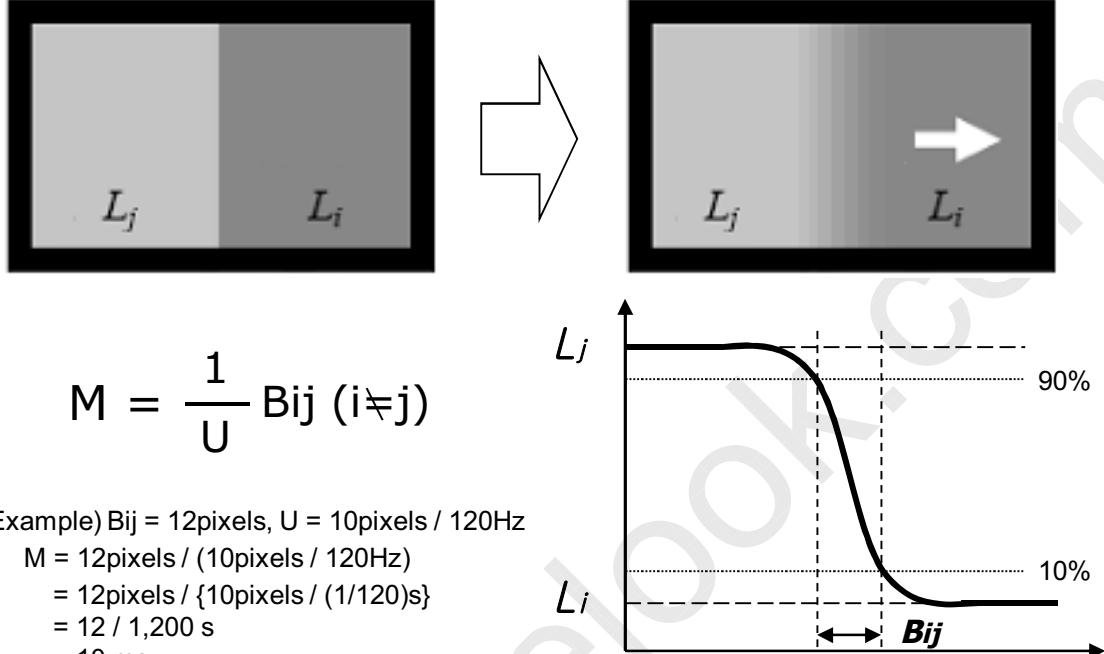


FIG. 4 MPRT

Dimension of viewing angle range

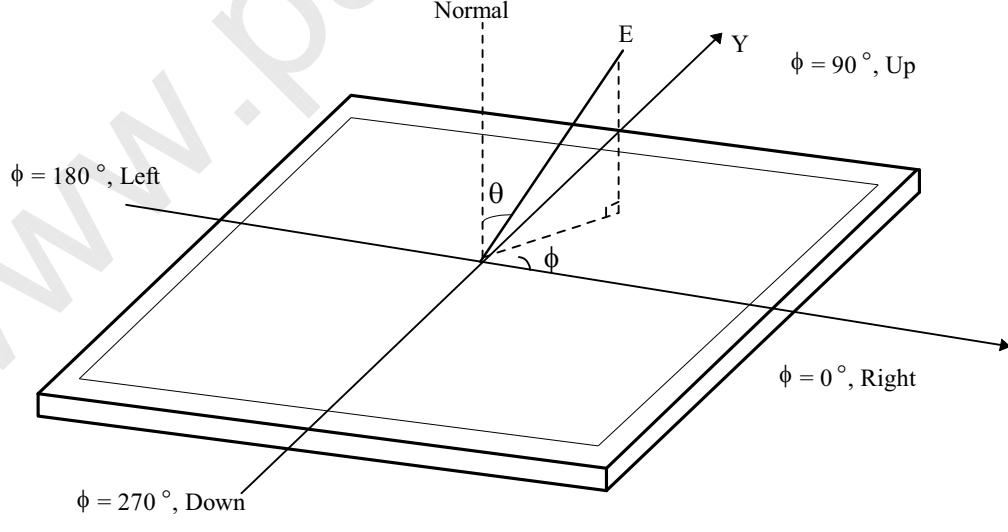


FIG. 5 Viewing Angle

LC840EQD

Product Specification

5. Mechanical Characteristics

Table 13 provides general mechanical characteristics.

Table 13. MECHANICAL CHARACTERISTICS

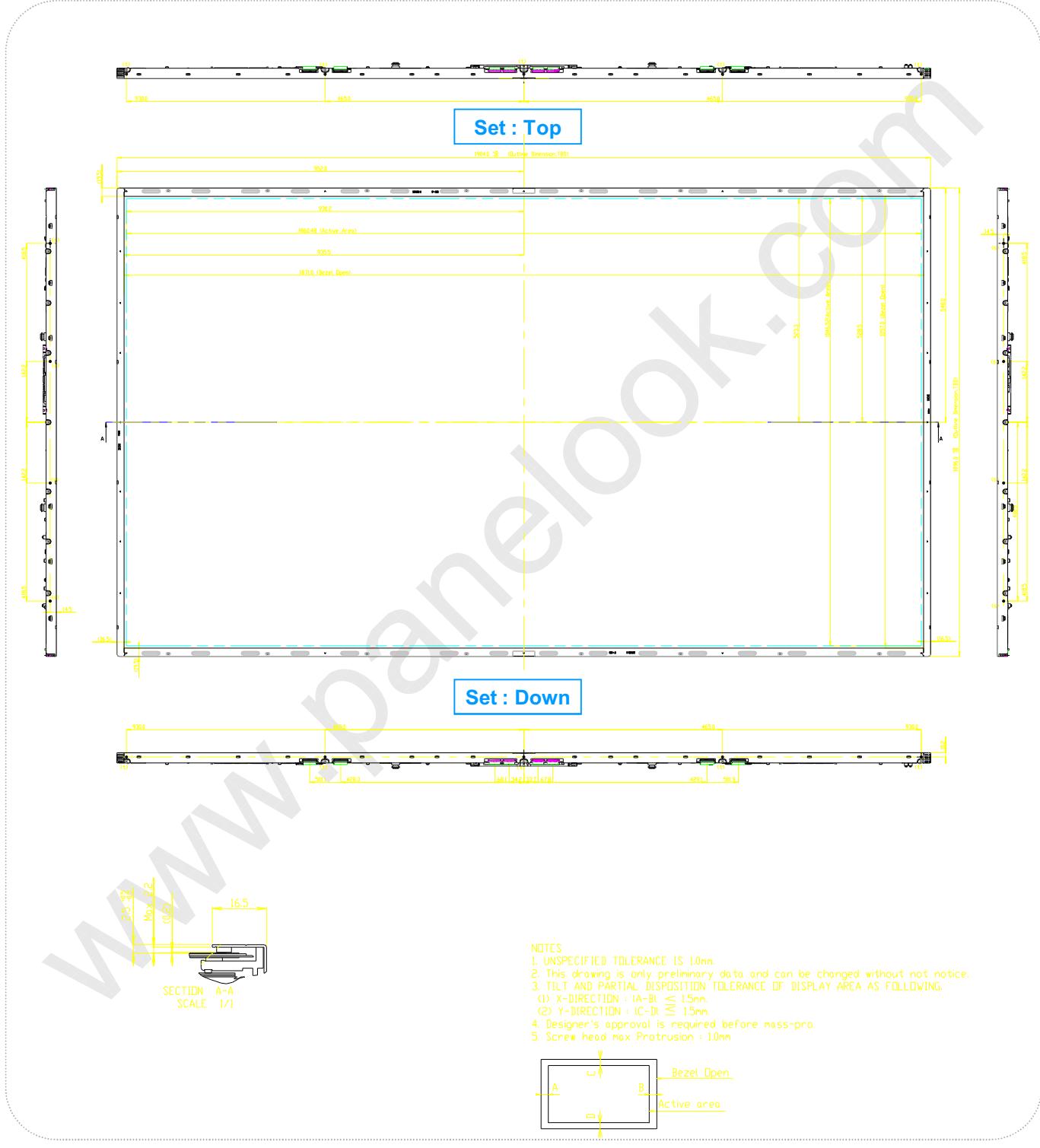
Item	Value	
Outline Dimension	Horizontal	1904.0 mm
	Vertical	1096.0 mm
	Depth	15.5 mm
Bezel Area	Horizontal	1871.0 mm
	Vertical	1057.0 mm
Active Display Area	Horizontal	1860.48 mm
	Vertical	1046.52 mm
Weight	43.5Kg (TBD) (Typ.), TBD kg (Max.)	

notes : Please refer to a mechanical drawing in terms of tolerance at the next page.

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Product Specification

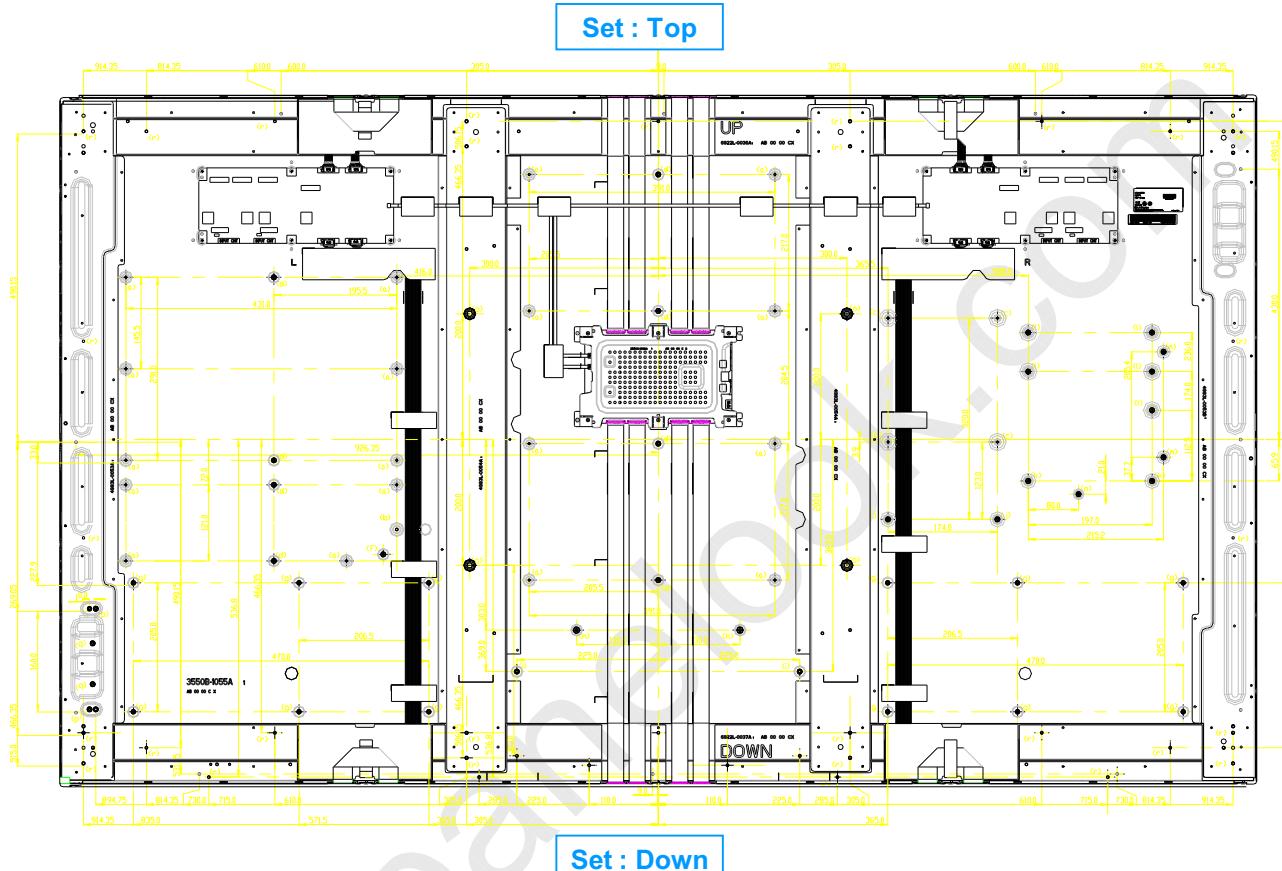
[FRONT VIEW]



LC840EQD

Product Specification

[REAR VIEW]



ITEM	TAP	Depth (mm)	Torque (kgf.cm)	Notes
(a)	M3.0	Max 4.0	5.0	Emboss
(b)	M4.0	Max 4.0	6.0	Emboss
(c)	M3.0	Max 5.5	5.0	Emboss
(e)	M4.0	Max 11.0	10.0	Pem_nut(2)
(f)	M3.0	Max 13.4	8.0	Pem_nut(3)
(g)	M4.0	Max 12.0	10.0	Pem_nut(4)
(h)	M4.0	Max 11.0	10.0	Pem_nut(5)
(i)	M4.0	Max 11.0	10.0	Pem_nut(6)
(k)	M3.0	Max 8.3	8.0	Pem_nut(7)
(l)	M3.0	Max 8.3	8.0	Pem_nut(8)
(m)	M3.0	Max 6.0	8.0	Pem_nut(9)
(n)	M3.0	Max 4.7	8.0	Pem_nut(9)
(o)	M8.0	Max 19.8	8.0	Pem_nut(10)
(p)	M3.0	Max 15.8	8.0	Pem_nut(11)
(q)	M3.0	Max 13.3	8.0	Pem_nut(11)
(r)	M4.0	Max 6.0	6.0	Rear Top
(s)	M3.0	Max 8.0	5.0	Side Top(1)
(t)	M3.0	Min7.2~Max 7.6	5.0	Side Top(2)

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Product Specification

6. Reliability

Table 14. ENVIRONMENT TEST CONDITION

No.	Test Item	Condition
1	High temperature storage test	Ta= 60°C 240h
2	Low temperature storage test	Ta= -20°C 240h
3	High temperature operation test	Ta= 50°C 50%RH 240h
4	Low temperature operation test	Ta= 0°C 240h
5	Vibration test (non-operating)	No Guarantee
6	Shock test (non-operating)	No Guarantee
7	Humidity condition Operation	Ta= 40 °C ,90%RH
8	Altitude operating storage / shipment	0 - 15,000 ft 0 - 40,000 ft

notes : Before and after Reliability test, LCM should be operated with normal function.

LC840EQD

Product Specification

7. International Standards

7-1. Safety

- a) UL 60065, Underwriters Laboratories Inc.
Audio, Video and Similar Electronic Apparatus - Safety Requirements.
- b) CAN/CSA C22.2 No.60065:03, Canadian Standards Association.
Audio, Video and Similar Electronic Apparatus - Safety Requirements.
- c) EN 60065, European Committee for Electrotechnical Standardization (CENELEC).
Audio, Video and Similar Electronic Apparatus - Safety Requirements.
- d) IEC 60065, The International Electrotechnical Commission (IEC).
Audio, Video and Similar Electronic Apparatus - Safety Requirements.
(Including report of IEC60825-1:2001 clause 8 and clause 9)

notes

1. Laser (LED Backlight) Information

Class 1M(TBD) LED Product

IEC60825-1 : 2001

Embedded LED Power (Class 1M) (TBD)

2. Caution

: LED inside.

Class 1M laser (LEDs) radiation when open.

Do not open while operating.

7-2. EMC

- a) ANSI C63.4 "American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz." American National Standards Institute (ANSI), 2003.
- b) CISPR 22 "Information technology equipment – Radio disturbance characteristics – Limit and methods of measurement." International Special Committee on Radio Interference (CISPR), 2005.
- c) CISPR 13 "Sound and television broadcast receivers and associated equipment – Radio disturbance characteristics – Limits and method of measurement." International Special Committee on Radio Interference (CISPR), 2006.

7-3. Environment

- a) RoHS, Directive 2002/95/EC of the European Parliament and of the council of 27 January 2003

LC840EQD

Product Specification

8. Packing

8-1. Information of LCM Label

a) Lot Mark

A	B	C	D	E	F	G	H	I	J	K	L	M
---	---	---	---	---	---	---	---	---	---	---	---	---

A,B,C : SIZE(INCH)

D : YEAR

E : MONTH

F ~ M : SERIAL NO.

Note

1. YEAR

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Mark	A	B	C	D	E	F	G	H	J	K

2. MONTH

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mark	1	2	3	4	5	6	7	8	9	A	B	C

b) Location of Lot Mark

Serial NO. is printed on the label. The label is attached to the backside of the LCD module.
This is subject to change without prior notice.

8-2. Packing Form

a) Package quantity in one Pallet : 6 pcs

b) Pallet Size : 2280 mm(W) X 780 mm(D) X 1354 mm(H)

LC840EQD

Product Specification

9. Precautions

Please pay attention to the followings when you use this TFT LCD module.

9-1. Mounting Precautions

- (1) You must mount a module using specified mounting holes (Details refer to the drawings).
- (2) You should consider the mounting structure so that uneven force (ex. Twisted stress) is not applied to the module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
- (3) Please attach the surface transparent protective plate to the surface in order to protect the polarizer. Transparent protective plate should have sufficient strength in order to resist external force.
- (4) You should adopt radiation structure to satisfy the temperature specification.
- (5) Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
- (6) Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment.
Do not touch the surface of polarizer for bare hand or greasy cloth.(Some cosmetics are detrimental to the polarizer.)
- (7) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzine. Normal-hexane is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer
- (8) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- (9) Do not open the case because inside circuits do not have sufficient strength.

9-2. Operating Precautions

- (1) Response time depends on the temperature.(In lower temperature, it becomes longer.)
- (2) Brightness depends on the temperature. (In lower temperature, it becomes lower.)
And in lower temperature, response time(required time that brightness is stable after turned on) becomes longer
- (3) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
- (4) When fixed patterns are displayed for a long time, remnant image is likely to occur.
- (5) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference.
- (6) Please do not give any mechanical and/or acoustical impact to LCM. Otherwise, LCM can't be operated its full characteristics perfectly.
- (7) A screw which is fastened up the steels should be a machine screw.
(if not, it can causes conductive particles and deal LCM a fatal blow)
- (8) Please do not set LCD on its edge.
- (9) The conductive material and signal cables are kept away from LED driver inductor to prevent abnormal display, sound noise and temperature rising.

Product Specification

9-3. Electrostatic Discharge Control

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly.

9-4. Precautions for Strong Light Exposure

Strong light exposure causes degradation of polarizer and color filter.

9-5. Storage

When storing modules as spares for a long time, the following precautions are necessary.

- (1) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.
- (2) The polarizer surface should not come in contact with any other object.
It is recommended that they be stored in the container in which they were shipped.
- (3) Storage condition is guaranteed under packing conditions.
- (4) The phase transition of Liquid Crystal in the condition of the low or high storage temperature will be recovered when the LCD module returns to the normal condition

9-6. Handling Precautions for Protection Film

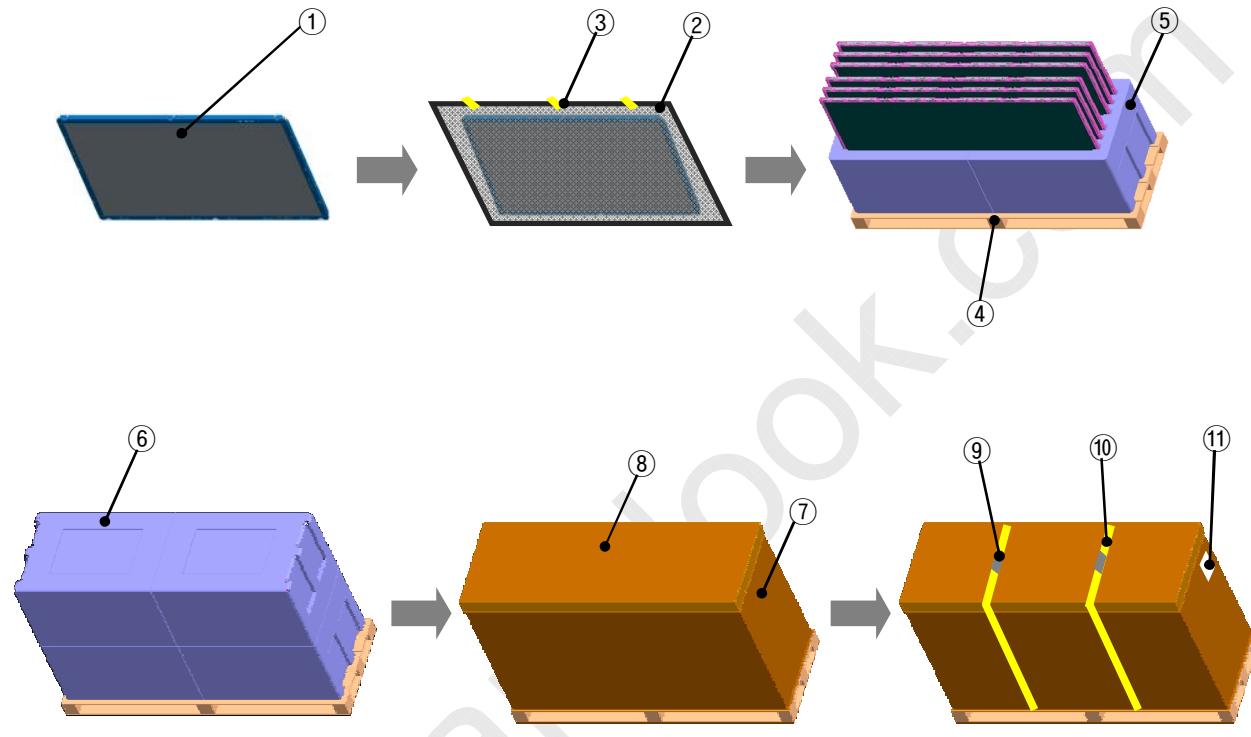
- (1) The protection film is attached to the bezel with a small masking tape.
When the protection film is peeled off, static electricity is generated between the film and polarizer.
This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.
- (2) When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the bezel after the protection film is peeled off.
- (3) You can remove the glue easily. When the glue remains on the bezel surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.

LC840EQD

Product Specification

APPENDIX-I

■ Pallet Ass'y



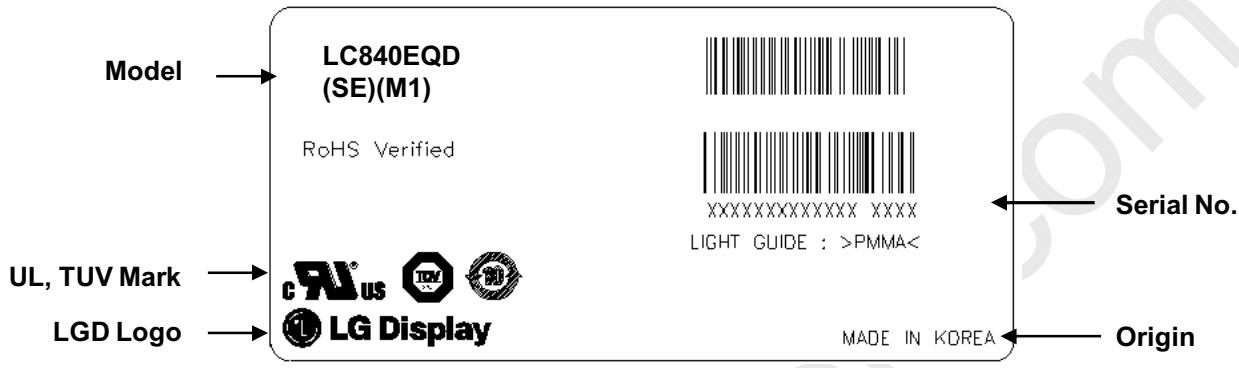
NO	DESCRIPTION	MATERIAL
1	LCD Module	84" LCD
2	BAG	AL Bag
3	TAPE	MASKING 20MM X 50M
4	PALLET	Plywood (2280X780X125)
5	PACKING	EPS
6	PACKING	EPS
7	ANGLE PACKING	PAPER
8	ANGLE COVER	PAPER
9	BAND,CLIP	STEEL
10	BAND	PP
11	LABEL	YUPO PAPER 80G 100X100

LC840EQD

Product Specification

APPENDIX- II-1

■ LCM Label

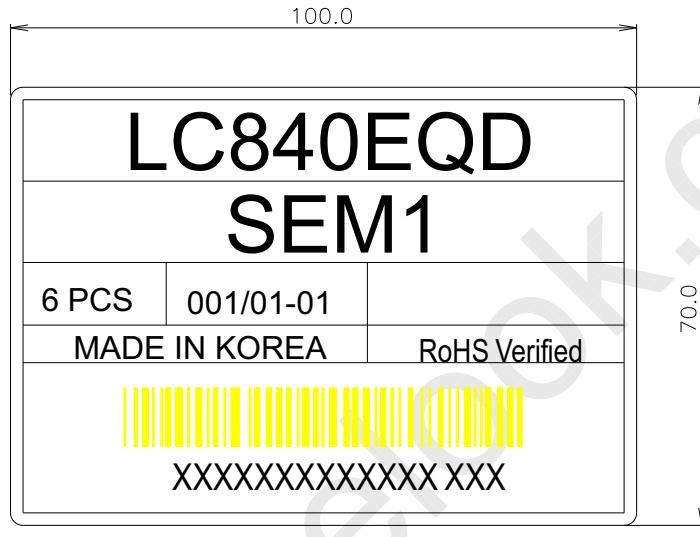


LC840EQD

Product Specification

APPENDIX- II-2

■ Pallet Label

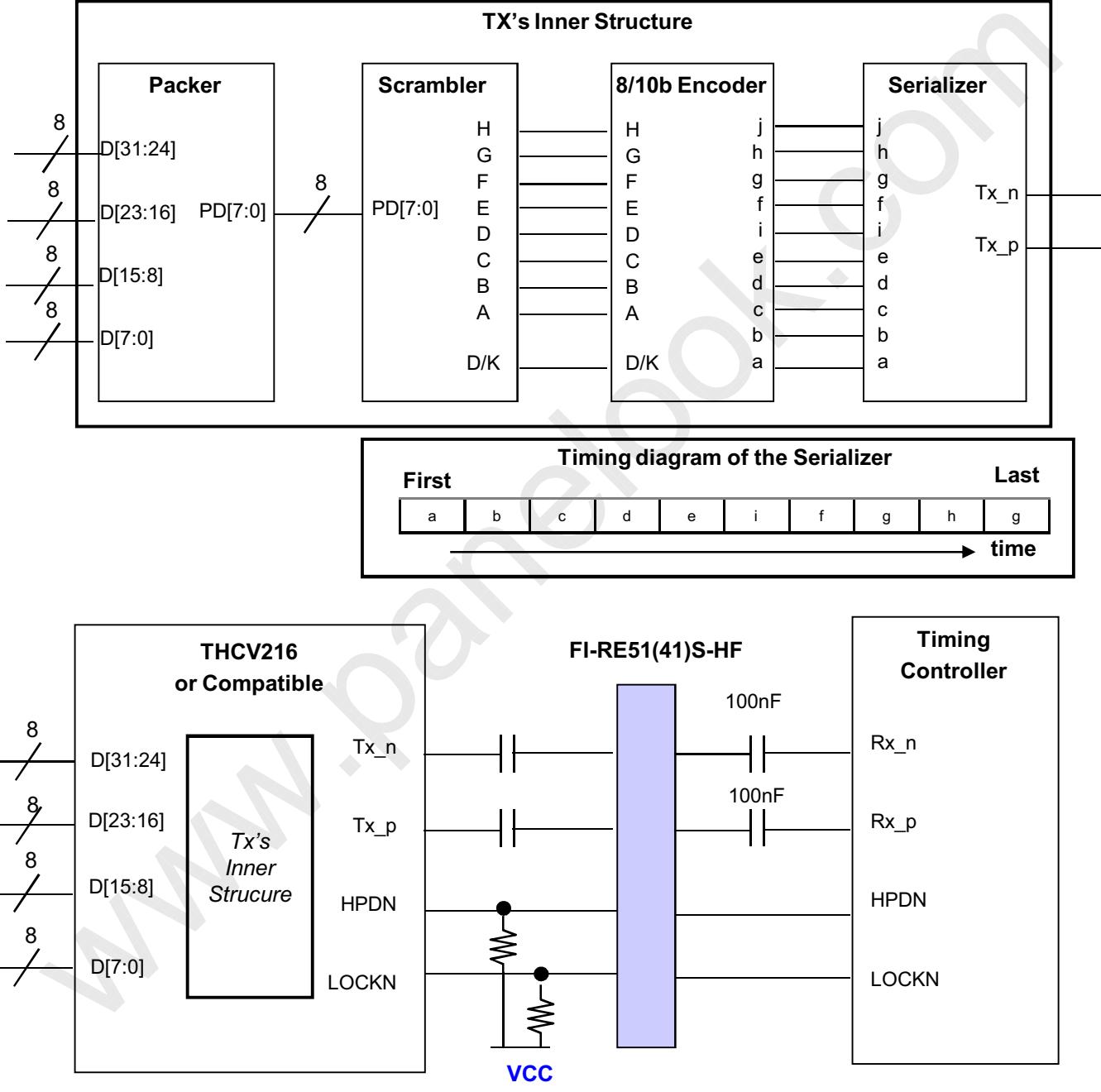


LC840EQD

Product Specification

APPENDIX- III-1

- Required signal assignment for Flat Link (Thine : THCV216) Transmitter



- notes:
1. The LCD module uses a 100 nF capacitor on positive and negative lines of each receiver input.
 2. Refer to Vx1 Transmitter Data Sheet for detail descriptions. (THCV216 or Compatible)
 3. About Module connector pin configuration, Please refer to the Page 8~9.

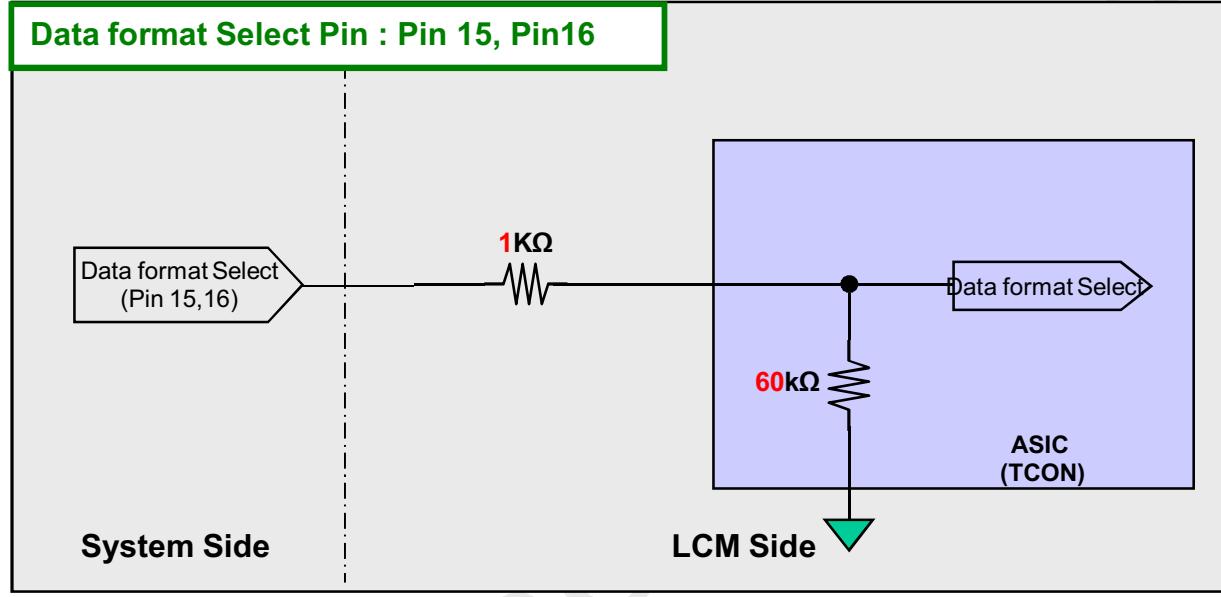
LC840EQD

Product Specification

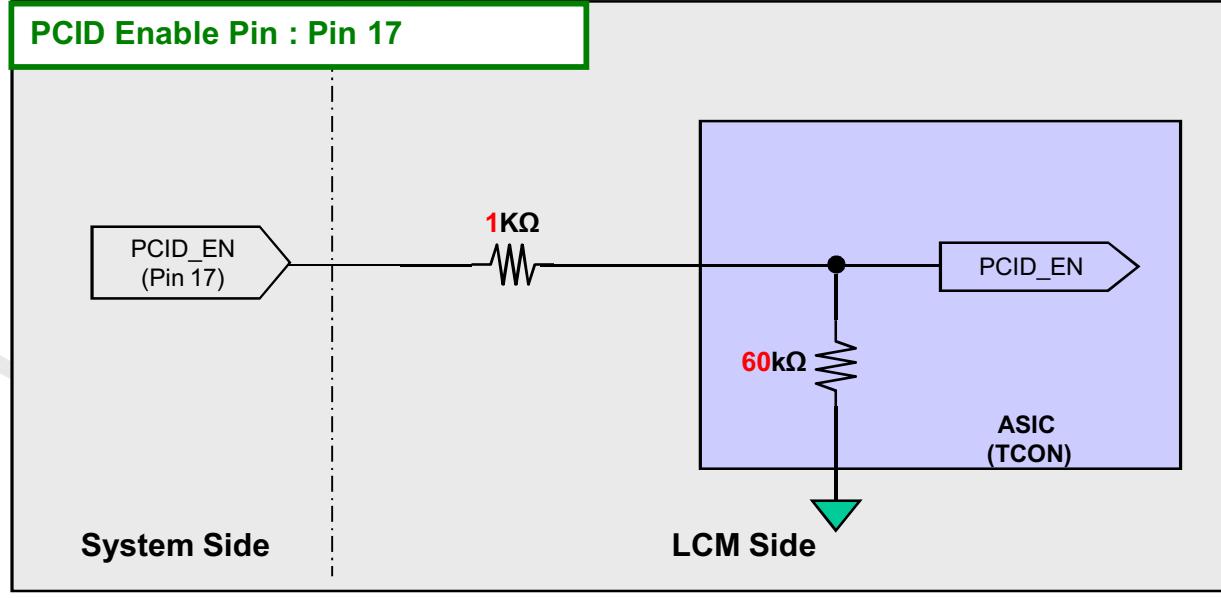
APPENDIX- IV-1

■ Option Pin Circuit Block Diagram

1) Circuit Block Diagram of Data format Selection pin



2) Circuit Block Diagram of L-DIM Enable Selection pin

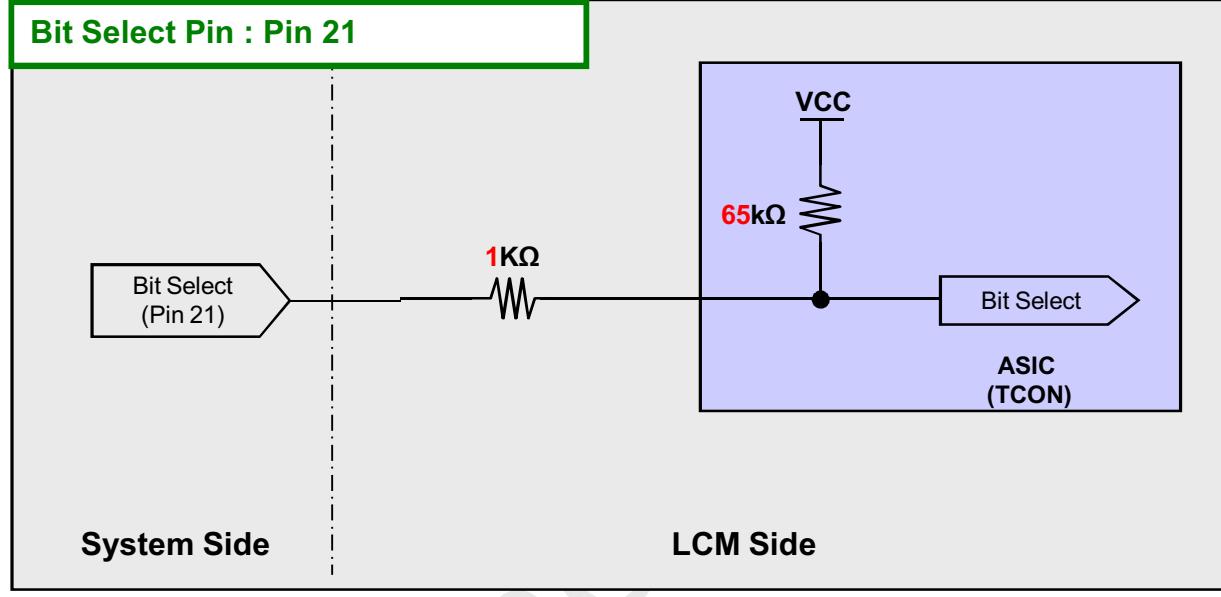


Product Specification

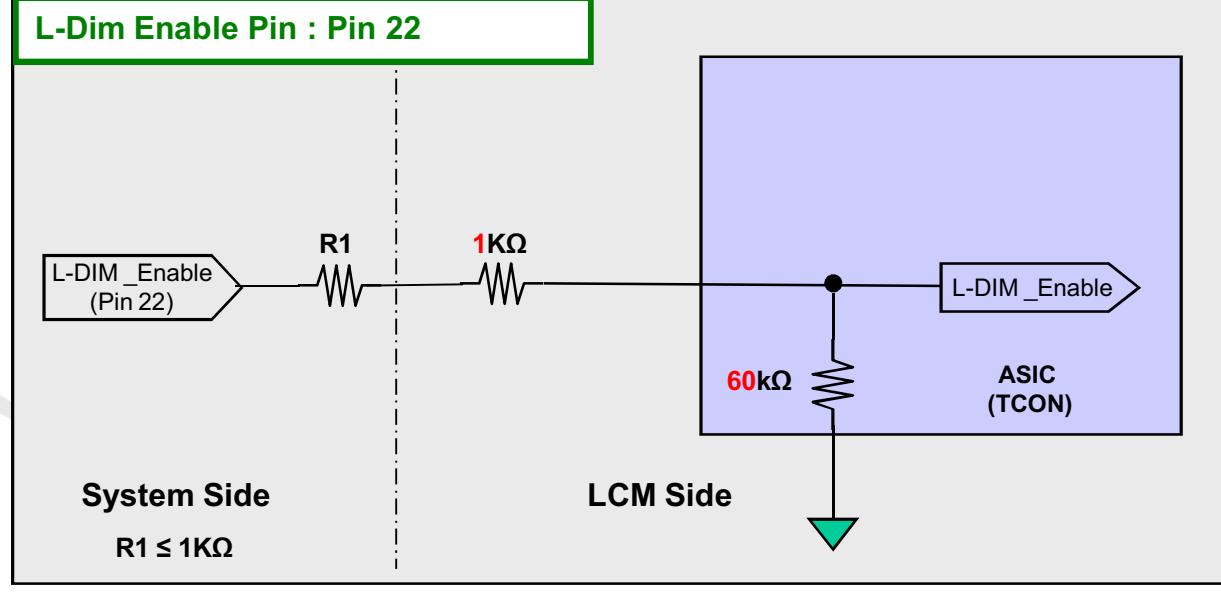
APPENDIX- IV-2

■ Option Pin Circuit Block Diagram

3) Circuit Block Diagram of Bit Selection pin



4) Circuit Block Diagram of L-Dim **Enable** Selection pin



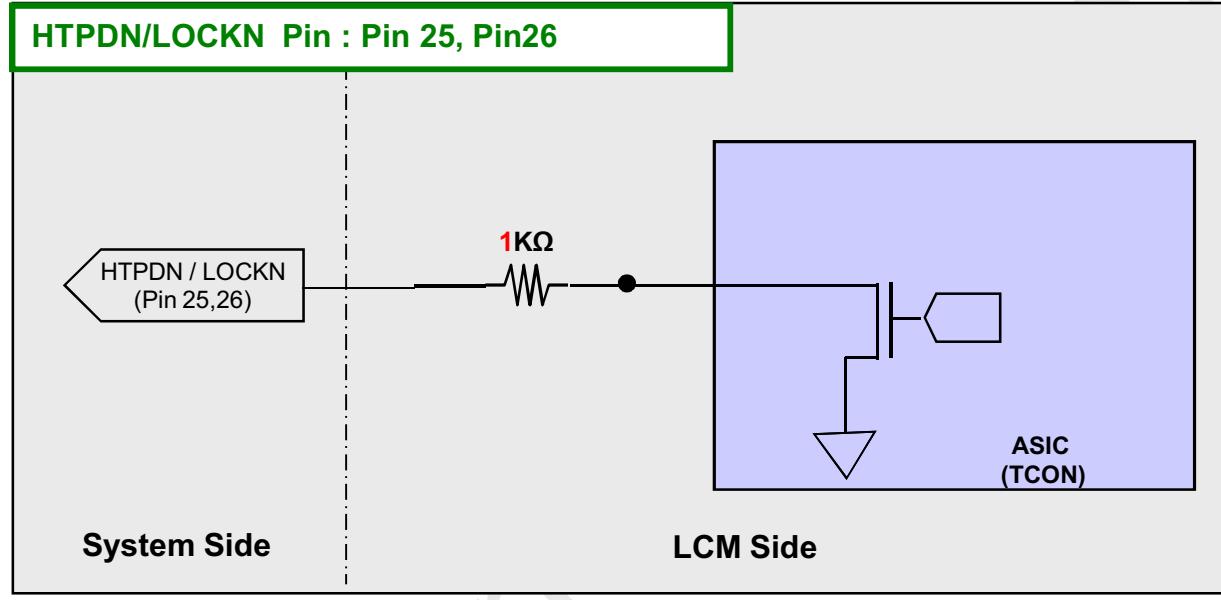
LC840EQD

Product Specification

APPENDIX- IV-3

■ Option Pin Circuit Block Diagram

5) Circuit Block Diagram of HTPDN/ LOCKN Selection pin



LC840EQD

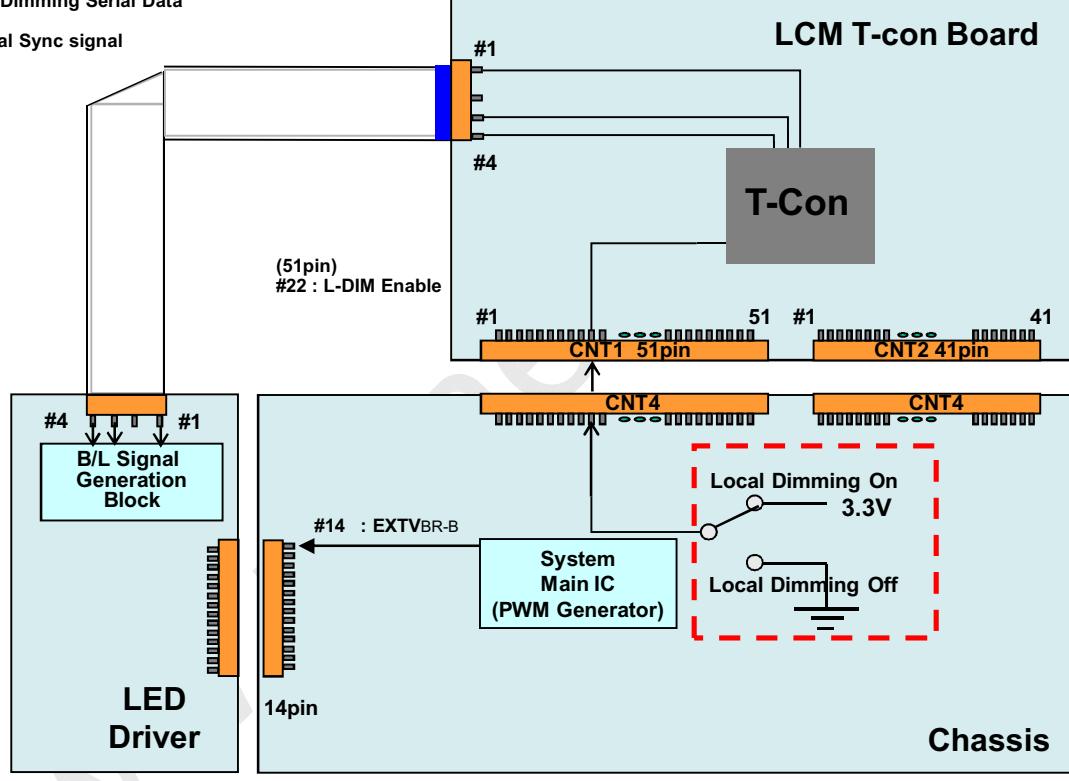
Product Specification

APPENDIX- V

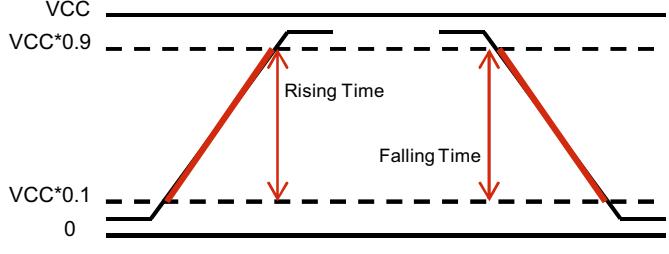
■ EXTVBR-B & Local Dimming Design Guide

- 1) When L-Dim Enable is "L", Vertical Sync Signal = System Dimming with 100Hz or 120Hz frequency.
- 2) Local Dimming signals are synchronized with V-Sync Freq. of System in T-Con Board.
- 3) EXTVBR-B Specification (VCC = 3.3V) @ Local Dimming
 - a) High Voltage Range : 2.5 V ~ 3.6 V
 - b) Low Voltage Range : 0.0 V ~ 0.8 V

(4pin)
 #1 : Local Dim Serial Clock
 #2 : Local Dimming Serial Data
 #3 : GND
 #4 : Vertical Sync signal



EXTVBR-B Frequency	100 Hz for PAL 120 Hz for NTSC
Rising Time	MAX 10.0 μ s
Falling Time	MAX 10.0 μ s



LC840EQD

Product Specification

APPENDIX- VI-1

Gray to Gray Response Time Uniformity

This is only the reference data of G to G and uniformity for LC840EQD-SEM1 model.

1. G to G Response Time :

Response time is defined as Figure3 and shall be measured by switching the input signal for "Gray (N)" and "Gray(M)".(32Gray Step at 8bit)

2. G to G Uniformity

The variation of G to G Uniformity, $\delta_{G \text{ to } G}$ is defined as :

$$\text{G to G Uniformity} = \frac{\text{Maximum}(G \text{ to } G) - \text{Typical}(G \text{ to } G)}{\text{Typical}(G \text{ to } G)} \leq 1$$

*Maximum (G to G) means maximum value of measured time (N, M = 0 (Black) ~ 1023(White), 128 gray step).

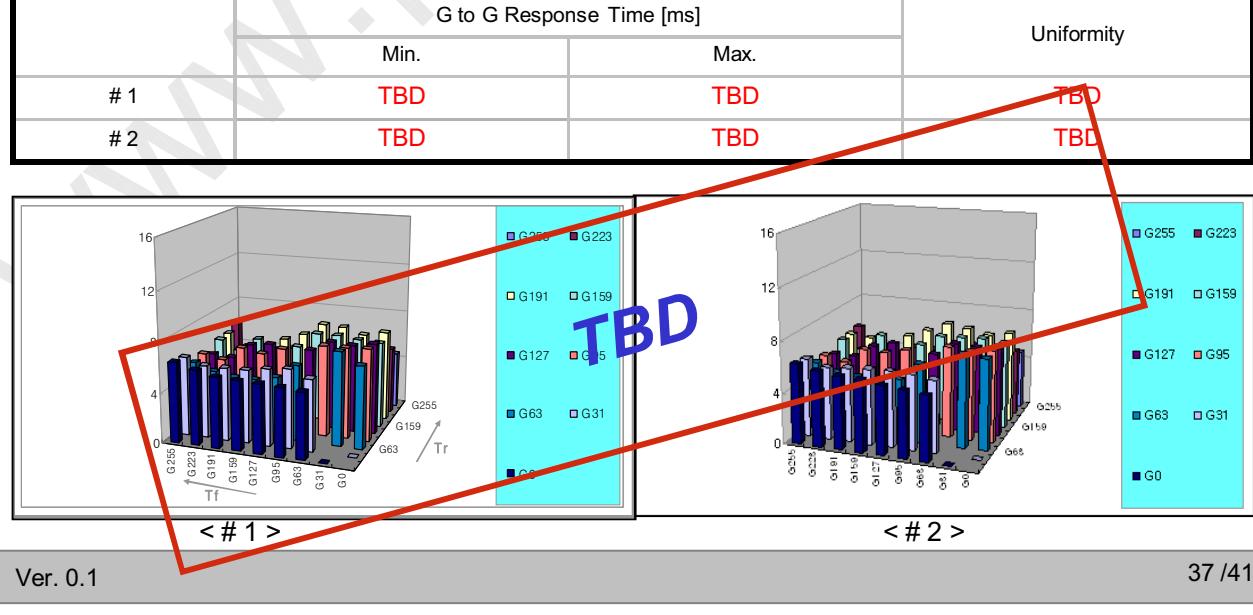
	0Gray	127ray	255Gray	...	895Gray	1023Gray
0Gray		TrR:0G→127G	TrR:0G→255G	...	TrR:0G→895G	TrR:0G→1023G
127Gray	TrD:127G→0G		TrR:127G→255G	...	TrR:127G→895G	TrR:127G→1023G
255Gray	TrD:255G→0G	TrD:255G→127G		...	TrR:255G→895G	TrR:255G→1023G
...
895Gray	TrD:895G→0G	TrD:895G→127G	TrD:895G→255G	...		TrR:895G→1023G
1023Gray	TrD:1023G→0G	TrD:1023G→127G	TrD:1023G→255G	...	TrD:1023G→895G	

3. Sampling Size : 2 pcs

4. Measurement Method : Follow the same rule as optical characteristics measurement.

5. Current Status

Below table is actual data of production on June. 15. 2012 (LGD RV Event Sample)



LC840EQD

Product Specification

APPENDIX- VI-2

■ MPRT Response Time Uniformity (δ_{MPRT})

This is only the reference data of MPRT and uniformity for LC840EQD-SEM1 model.

1. MPRT Response Time :

Response time is defined as Figure3

2. MPRT Uniformity

The variation of MPRT Uniformity , δ_{MPRT} is defined as :

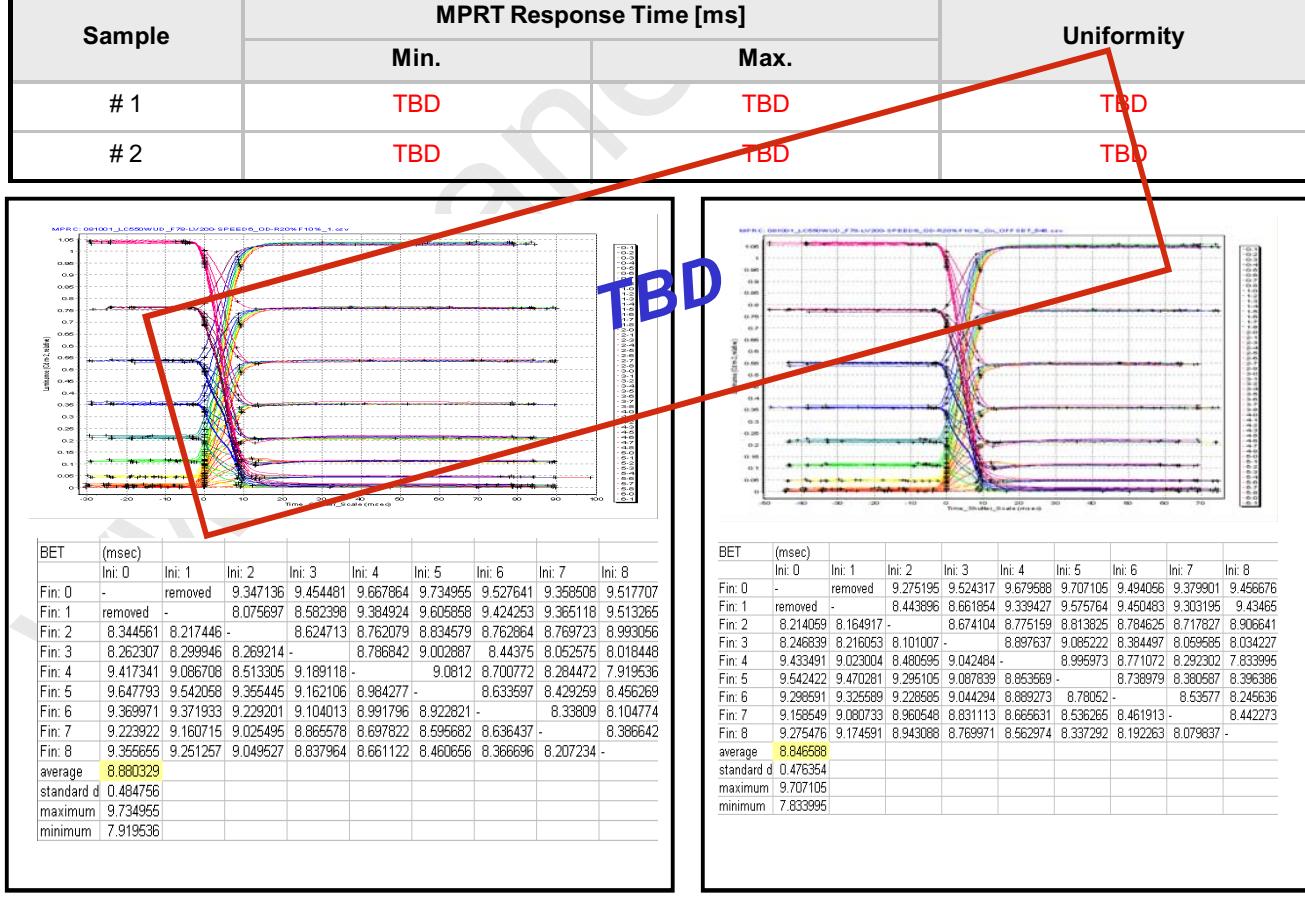
$$\text{MPRT Uniformity} = \frac{\text{Maximum (MPRT)} - \text{Typical (MPRT)}}{\text{Typical (MPRT)}} \leq 1$$

3. Sampling Size : 2 pcs

4. Measurement Method : Follow the same rule as optical characteristics measurement.

5. Current Status

Below table is actual data of production on June. 15. 2012 (LGD RV Event Sample)



LC840EQD

Product Specification

APPENDIX- VII

■ Standard specification of Eyeglasses

This is recommended data of Eyeglasses for LC840EQD-SEF1 model. (details refer to table)

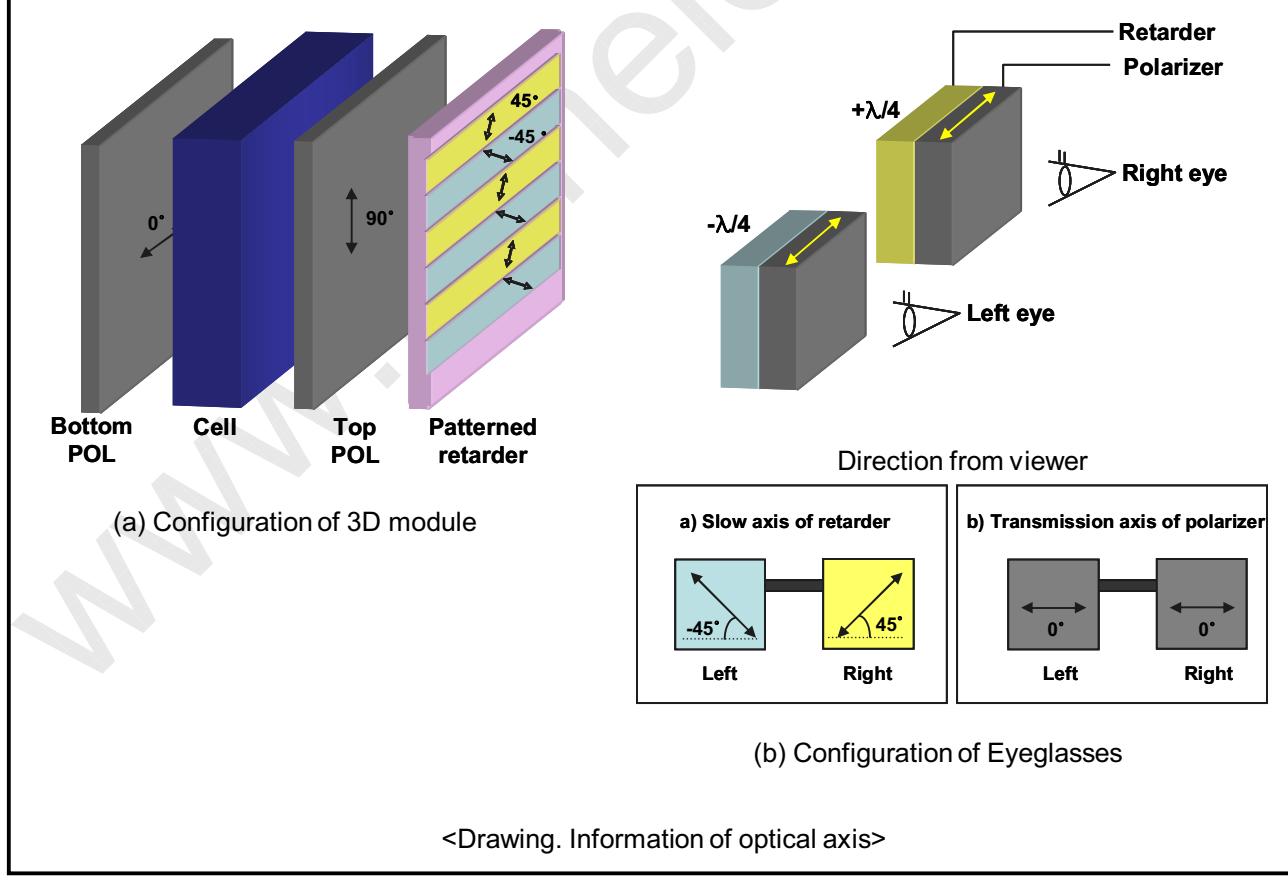
For each item, depending on the eyeglass manufacturer tolerances may occur, this tolerance can affect 3D performance. (3D Crosstalk, 3D luminance, 3D viewing angle)

<Table. Standard specification of Eyeglasses>

Design item of Eyeglasses		Left	Right	Remark
Optical axis	a) Slow axis of retarder	-45°	45°	Refer to drawing
	b) Transmission axis of polarizer	0°	0°	
Retardation value	Retarder		125nm	@550nm

* Recommended polarizer

Polarization efficiency: more than 99.90%



LC840EQD

Product Specification

APPENDIX- VIII-1

■ input mode of pixel data

Mode 1 : Non-Division			Mode 2 : 2 Division			
1st Data	2nd Data	Data #	1st Data	2nd Data	Data #	
Lane00	1	17	3825	Lane00	1	9
Lane01	2	18	3826	Lane01	2	10
Lane02	3	19	3827	Lane02	3	11
Lane03	4	20	3828	Lane03	4	12
Lane04	5	21	3829	Lane04	5	13
Lane05	6	22	3830	Lane05	6	14
Lane06	7	23	3831	Lane06	7	15
Lane07	8	24	3832	Lane07	8	16
<hr/>						
1st Data	2nd Data	Data #	1st Data	2nd Data	Data #	
Lane08	9	25	3833	Lane08	1921	1929
Lane09	10	26	3834	Lane09	1922	1930
Lane10	11	27	3835	Lane10	1923	1931
Lane11	12	28	3836	Lane11	1924	1932
Lane12	13	29	3837	Lane12	1925	1933
Lane13	14	30	3838	Lane13	1926	1934
Lane14	15	31	3839	Lane14	1927	1935
Lane15	16	32	3840	Lane15	1928	1936

LC840EQD

Product Specification

APPENDIX- VIII-2

■ input mode of pixel data

Mode 3 : 4 Division				Mode 4 : 8 Division							
①	②	①	②	①	②	①	②	①	②	①	②
①	②	①	②	①	②	①	②	①	②	①	②
1st Data		2nd Data		Data #		1st Data		2nd Data		Data #	
Lane00	1	5		957		Lane00	1	3		479	
Lane01	2	6		958		Lane01	2	4		480	
Lane02	3	7		959		Lane02	481	483		959	
Lane03	4	8		960		Lane03	482	484		960	
Lane04	961	965		1917		Lane04	961	963		1439	
Lane05	962	966		1918		Lane05	962	964		1440	
Lane06	963	967		1919		Lane06	1441	1443		1919	
Lane07	964	968		1920		Lane07	1442	1444		1920	
1st Data		2nd Data		Data #		1st Data		2nd Data		Data #	
Lane08	1921	1925		2877		Lane08	1921	1923		2399	
Lane09	1922	1926		2878		Lane09	1922	1924		2400	
Lane10	1923	1927		2879		Lane10	2401	2403		2879	
Lane11	1924	1928		2880		Lane11	2402	2404		2880	
Lane12	2881	2885		3837		Lane12	2881	2883		3359	
Lane13	2882	2886		3838		Lane13	2882	2884		3360	
Lane14	2883	2887		3839		Lane14	3361	3363		3839	
Lane15	2884	2888		3840		Lane15	3362	3364		3840	